

# UNITED STATES NAVY

## Medical News Letter

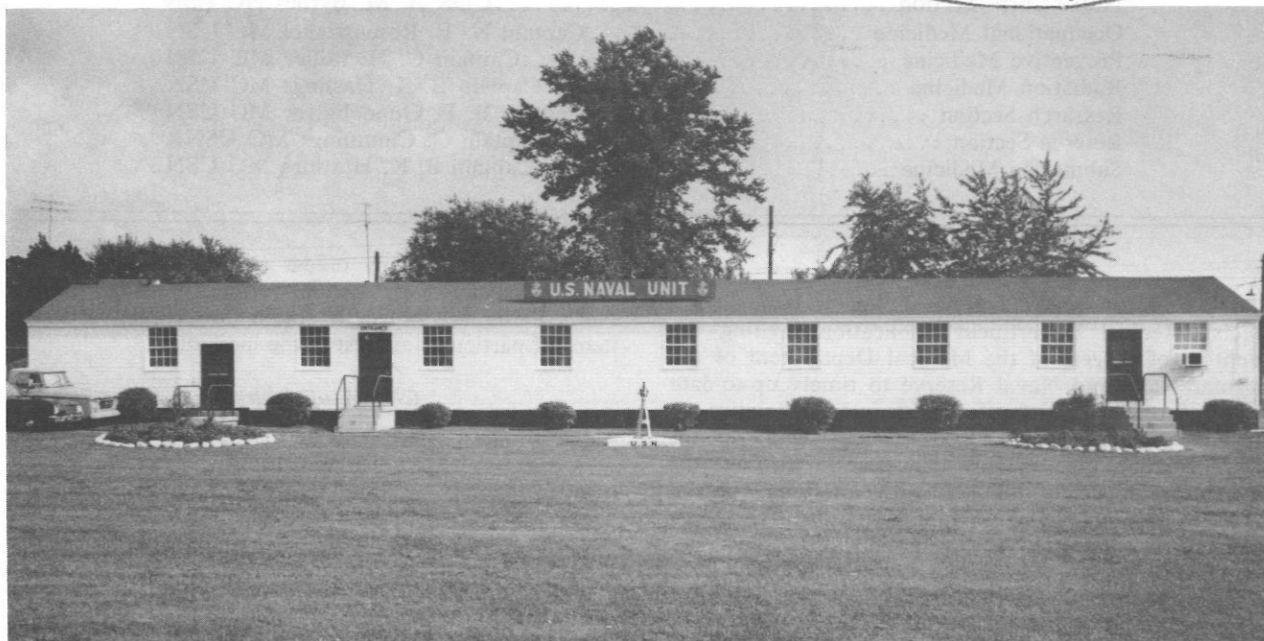
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FRONT COVER: NAVAL UNIT, FORT DETRICK, MARYLAND. This activity is located near Frederick, Md., about 50 miles northwest of Washington, D.C. It is under the command and technical management control of BUMED; it is within the Fifth Naval District. Fort Detrick was established by the Army in April, 1943 for biologic research; it became a joint operation by the addition of a Navy Unit, 8 February 1944. Although many research projects are engaged in jointly, the major use of Navy personnel and funds is in those of particular interest to the Navy alone. Basic research projects include those in nutrition, physiology, microbial genetics, aerobiology, immunology, host-parasite relationships, pathology, virology, biophysics and chemistry. Among the several contributions made by the research unit have been the development of vaccines, improvements in laboratory design, safe handling procedures involved in dealing with highly infectious micro-organisms, and the mass production of membrane filters now widely used in water analysis. Other basic research was accomplished at Fort Detrick in herbicides, plant growth regulators and defoliants. Early investigative work was done in the application of ethylene oxide and betapropiolactone as gaseous disinfectants. One of the more recently completed projects was the development of electronic equipment for counting and measuring aerosol agents. The current project receiving most attention concerns the prevention and control of airborne diseases using vapor phase disinfectants. One of the most important policies of the post is safety. Researchers at Fort Detrick have long been recognized as leaders in laboratory safety procedures. They have developed and perfected new methods and equipment to protect surrounding communities and the workers who are engaged in general research programs. Medical Service Corps officers have commanded the Naval Unit since 1947. All Navy officers assigned to the unit are microbiologists, who with hospital corpsmen and a disbursing clerk, comprise the Navy personnel assigned to this duty station.

The issuance of this publication approved by the Secretary of the Navy on 4 May 1964.

U.S. NAVY MEDICAL NEWS LETTER VOL. 52 NO. 4

## FATAL CASE OF GAS GANGRENE ASSOCIATED WITH INTRAMUSCULAR INJECTIONS

P. W. Harvey,\* VRD, MB, CH.B., F. C. PATH., D. PATH.; G. V. Purnell,† MB, CH. B., "Reprinted from the *Brit Med J* 1968, Volume 1, Page 744-746, by permission of the Authors, Editor and Publishers."

This paper reports a case of fatal gas gangrene complicating a simple therapeutic injection of adrenaline mucate given in a hospital ward.

Touraine and Gautier (1936) went to considerable lengths to conceal the identity of their patient in a case similar to the one which we are reporting, and in all probability the fear of litigation has inhibited the publication of other reports. In fact, the description of this case has been delayed because a colleague originally vetoed publication. It should be emphasized that this patient died some years ago, in another place, and was in no way connected with the towns where either of us now practise.

The development of central sterile supply departments and the more recent introduction of disposable sterilized equipment have greatly reduced, but by no means eliminated, the risk of infection, which can be introduced by injections (Cayton and Morris, 1966).

It is highly probable that the present patient would still have died even though the syringes and needles used to treat him had been prepared in accordance with the techniques employed now, many years after the tragedy.

### Case Report

A 22-year-old man was admitted to hospital with severe status asthmaticus. During the first 18 hours treatment consisted of intravenous injections of aminophylline followed by intramuscular aminophylline, Hyperduric adrenaline, and Gardenal sodium (phenobarbitone sodium).

On the morning of the second day he was very much better, though he complained of some pain in the lower lumbar region and both buttocks. The consultant physician in charge of the case examined

the patient, paying special attention to the buttocks, which had been the site of some of the intramuscular injections. He found no evidence of an inflammatory reaction or of focal tenderness. The patient's improvement was maintained throughout that day and evening, though he still complained intermittently of low back pain.

Early on the morning of the third day he became very restless and appeared to be ill. He was found to have acute peripheral circulatory failure, the blood pressure being unrecordable. There was a diffuse swelling over the right buttock and the lateral aspect of the upper third of the right thigh. Palpation of this swelling revealed obvious crepitus. Gas gangrene infection was diagnosed and the appropriate treatment instituted at 08.30 hours. This included intravenous anti-gas-gangrene serum, penicillin, and noradrenaline transfusions. Initially 1,000,000 units of penicillin was given intramuscularly and 500,000 units intravenously.

One hour later the patient showed no evidence of response, so 200 mg. of hydrocortisone and a further 500,000 units of penicillin were added to a glucose drip. In spite of these measures he died at 12.30 hours—that is, four hours later. In retrospect, it is important to note that he had been incontinent of faeces on admission to the ward.

Necropsy was performed by Dr. G. B. Manning (Home Office pathologist) in our presence. The findings were of a classical gas-gangrene infection which appeared to have arisen from a needle track 2 in. (5 cm.) long in the muscle of the right buttock. Subsequent histology confirmed the necropsy findings and also revealed a generalized septicaemia due to Gram-positive bacilli.

Gram-positive bacilli were cultured from the needle track and from subcutaneous tissue in the lumbar region as well as from the patient's faeces. The colonial appearances, the cultural characteristics, and the sugar and Nagler reactions of all three

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strains were identical and typical of *Clostridium welchii*.

The cultures were sent to the Central Serological Laboratory, London, for further investigation. The toxins produced by the three strains were identical and consisted of alpha, theta, and kappa toxins. The strains were therefore *Cl. welchii* type A.

\* Universal containers of Robertson's meat medium containing pure cultures of the organism were left on the bench for some months at room temperature. When the cultures were re-examined special stains confirmed that spores had formed. In due course sterile filter paper was impregnated with these spores and used for heat-resistance tests.

## Literature

The dangers of gas gangrene occurring in operating-theatres is generally recognized (Brit Med J, 1967), but it is less widely known that this infection can arise at the sites of intramuscular injections.

Mabin (1936) lists 84 cases, none of them in the English literature. The majority were reported from Germany and Italy and there were 10 cases from France. Further cases have since been published in the French literature by Touraine and Gautier (1936), Lagrot (1938), Brocard (1940), and Ramond (1942). We have found only three reports in the British literature (Harris, 1937; Cooper, 1946; Tonge, 1957).

Ramond (1942) pointed out the fulminating course followed by cases due to injection, and stated that death usually took place within 48 hours. This was certainly so in the case which we are reporting. Lagrot (1938) stated that the statistics showed a 94 percent mortality. Mabin (1936), reviewing 84 cases, pointed out that one-third of these were associated with injections of adrenaline, and that more cases of gas gangrene were associated with the injection of this drug than with any other. According to Mabin, in only 11 of the 84 cases which he had collected was an organism identified, and in each case it was *Cl. welchii*. In all subsequent reports which we have studied, where an organism has been identified it has been *Cl. welchii*.

Experimental work by Cooper (1946) and by Evans, Miles, and Niven (1948) has shown that adrenaline, administered intramuscularly, enormously enhances the danger of infection by *Cl. welchii*.

Pallasse (1936), Touraine and Gautier (1936), Lagrot (1938), and Ramond (1942) think that the *Cl. welchii* are of endogenous origin, the organisms being present at the site of injection as the result

of a transient symptomless bacteraemia originating from the bowel. There is, however, no evidence that such a bacteraemia occurs, and both Brocard (1940) and Cooper (1946) reject this theory.

In the case reported by Cooper the needle and syringe were kept in spirit, and as it is known that *Cl. welchii* spores can survive in 96 percent alcohol she thought that the syringes and needles were the most likely source of the infection. The syringe used for the fatal injections of adrenaline in oil in the case reported by Tonge (1957) was kept in a solution of Dettol in 70 percent alcohol in a special container, and boiled once a week, though the needles, which were carried in a screw-capped container, were boiled daily.

## Discussion

In our case the syringe and needles were boiled for at least five minutes just before each injection. Filter-paper impregnated with spores cultured from the needle track germinated after two minutes' boiling, but there was no growth after three minutes at 100° C. It was therefore thought that the normal procedure then employed for sterilizing syringes and needles in the ward had been adequate. Though this form of sterilizing by boiling is not now acceptable (M. R. C., 1962) it was the usual practice in hospitals at the time when this death occurred.

Tests were carried out in the wards very soon after the tragedy, but no aerobic or anaerobic growth was obtained at any time from the syringes or needles found there.

All the materials injected were prepared by well-known pharmaceutical manufacturers, and it is most unlikely that the infection originated from these sources. The only material remaining for bacteriological examination was a rubber-capped stock bottle of procaine and phials of Cardophyllin (theophylline-ethylenediamine) and of Hyperduric adrenaline in the cartons from which phials had been taken for injection into the deceased. The contents and external surfaces of all these glass containers were cultured for *Cl. welchii*, but none grew.

The possibility that the infection originated from *Cl. welchii* spores contaminating the skin cannot be easily dismissed. It is known that these spores are often found on the skin of the buttocks and thighs when they are present in the faeces, and no practical method of cleansing will destroy them (Garrod, 1956; M. R. C., 1962). The fact that the cultures from the patient's wound and faeces were similar supported the hypothesis that the infection was due



to inoculation of *Cl. welchii* derived from the patient's own faeces by an injection of Hyperduric adrenaline. This hypothesis could not be confirmed or refuted, as all the strains of *Cl. welchii* concerned were untypable.

Shortly after the young man died two old men in the same ward were found to have gas in the tissues at points where injections had been made into the buttocks. *Cl. welchii* type A was isolated from both these wounds. Neither of them showed clinical evidence of gas gangrene. In both cases the infections involved subcutaneous fat and not muscle. Both patients were debilitated and were incontinent of faeces. It is our opinion that the probable sources of infection in all three cases were spores from the patients' own faeces.

Though all injection sites were infected with *Cl. welchii* type A only one person, a robust young man, died. The other two patients, both aged and feeble, appeared to suffer no serious ill effects.

The fact that the fatal case alone was associated with injections of Hyperduric adrenaline is of crucial importance. The vasoconstriction caused by adrenaline lowers the oxygen tension to a point which enables anaerobic organisms to grow. Evans *et al.* (1948) have shown experimentally that infection by *Cl. welchii*, in particular, is greatly enhanced by the presence of adrenaline at the site of injection. They concluded that the injection of 2 µg. of adrenaline into the thigh muscles of guinea-pigs enhanced such infection at that site 100,000 times. In their experiments a simple solution of adrenaline was used. In the case reported here at least 500 µg of adrenaline was injected, combined with mucic acid.

This association of Hyperduric adrenaline with *Cl. welchii* bacilli is thought to have been responsible for the fulminating course of this infection and for the fatal outcome of the case.

Hyperduric adrenaline is the trade name for adrenaline mucate. It is thought that this form of adrenaline has been produced by one firm only. It has recently been withdrawn by the manufacturers for economic reasons, together with the other Hyperduric preparations. It consists of adrenaline 0.1 percent, mucic acid 0.2 percent, NaCl 0.9 percent, phenyl mercuric nitrate 0.002 percent, sodium metabisulphite 0.15 percent and aqua pro inject. ad 100 percent. Its prolonged action is due to hydrolysis of adrenaline mucate within the tissues to release pharmacologically active adrenaline. Equal volumes of adrenaline injection B. P. (1:1000) and of Hyperduric adrenaline contain equal quan-

ties of adrenaline. That contained in the mucate is released slowly; activity may be detected in 30 minutes and continue for as long as eight or even 12 hours.

The effect of *Cl. welchii* and its exotoxins on adrenaline mucate is not known.

### Conclusions

*Cl. welchii* are ubiquitous and easily cultured from dust.

These organisms must often contaminate sterilized syringes and instruments, yet reports of their causing trouble are few. *Cl. welchii* are frequently cultured from wounds in which they appear to be of little importance and certainly do not cause gas gangrene.

Whatever the source of the bacteria, it was the presence of adrenaline in the tissues which exacerbated the infection and brought about the death of the patient. In the other two cases the infection, also in the buttocks, had no significant effect on the clinical progress.

The possible presence at the site of an intramuscular injection of spores on the skin is a hazard which still cannot be eliminated. It is therefore our practice to avoid injections of adrenaline into the buttock whenever possible.

### Summary

A fatal case of gas gangrene is reported. It followed a therapeutic injection of adrenaline mucate in a hospital ward, and is thought to have been due to spores derived from the patient's own faeces which contaminated the skin and were driven into the muscle by the injection needle. They germinated in the favourable environment induced by the adrenaline.

There is no adequate way of sterilizing the skin to prevent such tragedies, so adrenaline injections should not be made into the buttock.

The literature, mainly from Europe, is reviewed.

We should like to record our appreciation of the assistance given to us by the late Colonel H. J. Benstead of the Central Laboratory at Colindale, London. We are also grateful to Professor C. L. Oakley, F. R. S., for his advice and comments, to Mr. J. D. Bellis for assistance with pharmacological data, and to Miss Sylvia Curwen for typing.

(The references may be seen in the original article.)

## THE PHYSIOLOGICAL CLOCK

Robert Edgar Mitchell, Jr., MD, *Virginia Med Monthly*  
95:52-55, January 1968.

External time signals are noted in the color change of a certain fiddler crab species (*Uca*) which is in tune with tidal and diurnal rhythms, as well as semi-lunar rhythm. Even the lowly potato may be shown to have increased oxygen consumption (by the slice technique) during the day, particularly the early morning, and to decrease its oxygen consumption during the night. There is also correlation between external barometric-pressure and oxygen consumption, but it is not so definite as the day-night cycle.

There are now many factors pointing toward biochemical and/or biophysical systems within organisms which may ultimately control the circadian rhythms. We are not clear how these systems work but the hypothesis now extant is based on the fact that the observed rhythms are independently maintained. To complicate things more, there is the obvious fact that there is significant species variation in their diurnal periodic rhythms.

Terrestrial magnetism is shown to fluctuate rhythmically with solar and lunar periods. The paths of certain mud snails will show a linear directional movement varying with the time of day and the lunar cycle. When this magnetic field is changed by artificially increasing an oblique field to that of the earth's, the snails were found to adjust to one field during the day and the other at night. This led investigators to conclude that organisms are at all times under the influence of environmental variables.

The effects of cosmic radiation on elemental life forms have also been investigated and screening with lead shields does not seem to stop the changes.

In a natural environment the timing of biologic phases is controlled by genetic inheritance and variation of light conditions of the environment. Phase-shifts of the circadian rhythm may be inhibited completely by affecting RNA synthesis. Also, the various phase cycles may become disoriented in time and not occur in concert. This would also destroy the neatly timed rhythmic cycle. It would appear, then, that the rhythm of life, so to speak, is under the control of internal and external stimuli, although neither may be positively proved by studies at hand to date. The implication of RNA in the timing mechanism suggests many external stimuli

such as x-radiation, certain antibiotics (i.e., chloromphenicol, actinomycin-D) and ultra-violet irradiation. Endogenous hormones, neurosecretory mechanisms, and enzymes, poorly identified, may alter the biologic clock.

It should be noted at this point that there are many who disagree as to the effect of extraneous forces (as barometric pressure, geomagnetic fields, cosmic rays and the like) and state categorically that frequencies of all biologic clocks are genetically guided. They claim the residual periodic variables function after elimination of obvious external factors.

There is a definite synchronization of rhythms within the same species. This is thought advantageous. Rhythmicity is characteristic of nature. No living thing is static.

Early in this century, it was shown that certain elemental marine organisms showed cycles of behaviour with the same frequency as that of the tides in the areas where they had been collected. One observer noted that ancestors of all present-day living things were subjected to the pull of the tides and that this becomes a sort of built-in clock to our daily rhythms. Breeding rhythms definitely occur in certain plants and animals, especially marine life, and there are those who hold that this also occurs in human childbirth. Caspers reviewed the alleged and observed correlations between lunar rhythm and menstruation rate, distribution of births, urine secretion and color vision changes in man. No conclusions could be drawn of any statistical significance. Bats have been shown to have a seasonal change in size of their testes, which increase from January to June and decrease in size from October to December. Tropical climates eliminate the so-called breeding season in animals but the cycle goes on in a different time cycle nevertheless.

Halberg described, quantitatively, eosinophile rhythms in terms of a peak in the morning and low at night. Reversal of light source here will reverse the eosinophile rhythm. In this same regard, there have also been described rhythms in numbers of thrombocytes, leucocytes, and red blood cells as well as cholesterol and blood sugar, blood chloride, pulse rate, blood pressure. Halberg also reported blood eosinophile and rectal temperature rhythms persisting in man after subtotal removal of a cerebral hemisphere. The regular variations in sleepiness,

temperature, and urinary flow, according to Mills, might be related to an habitual hypothalamic rhythm ultimately derived from external rhythms. Kleitman noted the remarkable persistence of normal temperature and urinary rhythms in night workers in urban communities, as well as diurnal fluctuations of temperature, sleepiness, wakefulness.

Halberg feels that the adrenal cycle describes processes occurring in preparation for daily activities instead of being a reflex reaction or feedback response to them. Kleitman felt that the rhythm of body temperature appeared to be affected by the environment. Potassium excretion was thought, however, determined by an intrinsic twenty-four mechanism.

The search for a center controlling diurnal rhythms has led many investigators far afield but to date no one area has been found. Hypophysectomy and thyroidectomy according to Richter, may disturb the rhythm but not eliminate it. This is also true in subtotal gastrectomy.

Lewis and Lobban conclude that sleep rhythm is controlled by an area of the hypothalamus (not further localized) as are retention of water, chlorides, and body temperature. Potassium excretion on the other hand is under the aegis of the adrenal cortex. There must, obviously, be no single biologic clock system, even though Swan has suggested that probably all cells possess an inherent twenty-four hour rhythm. Halberg described the number of eosinophiles in the blood reflecting the course of the adrenal cycle. The adrenal gland hormones diminish the number of eosinophiles, the chief basis of our present-day "Thorn" test. Removal of the adrenal gland abolishes eosinophilic rhythm as well as glycogen rhythm in the liver according to Agren. The central nervous system is not required for adrenal rhythm as evidenced by the cycle being found in brainless animals, as noted by Halberg.

The biologic clock may be "set" by light-dark cycles or by temperature controls, as alluded to above, but all living matter display incessant movement to a degree in space and time. The endogenous rhythm will correlate with the external rhythm but persist even though the external stimuli are removed. There is a definite time sense of plants and animals.

Seasonal rhythms occurring in pathology, are well known and add up to a seasonal mortality rhythm. Many infectious diseases have seasonal peaks. Children are thought to grow rhythmically with a peak in spring. Even certain disease states will have a definite rhythm. An example is given by Baker who noted his patient to have maximum knee-joint swelling every seven days in intermittent hydrarthrosis

(secondary to brucellosis). Periodicity and rhythmicity of peptic ulcer disease and to a lesser extent, chronic ulcerative colitis exacerbations and diseases of atopy (Spring-Fall) are well known. Also it is temptingly intriguing to include here the various conditions which lead to antibody formation of which Hashimoto's disease of the thyroid may be considered a prototype. Less well known but also recorded, Leonard showed freedom of symptoms in his patient with Parkinson's disease at certain times each day. The 280 day cycle of pregnancy would also be included here.

The periodic swelling and regression of the lymph glands and, presumably, corresponding fluctuations in numbers of lymphocytes, as well as the characteristic temperature variations, are noted in the Pel-Ebstein type of Hodgkin's disease. There is also evidence to show the presence of a biological clock in varied phases of catatonic-schizophrenia according to Richter. The periodic illnesses of Reimann may also be cited here.

Since we now have laboratory conditions available to permit fairly accurate measurement of circadian rhythmical oscillations, we are able to recognize organisms indicating and making use of the time of day by their biological clocks. This has intensified interest in time-measurement in physiopathological disturbances, as mentioned earlier. It might be noted, especially, on space voyages where test subjects have great difficulty adjusting to rapidly changing day-night cycles which deviate too much from their usual twenty-four hour cycle or on long modern submarine trips where the day-night cycle rarely changes and adjustment is necessary and often difficult.

Like it or not, we must accept rhythms in our diagnostic armamentarium if we are to succeed in early diagnosis. Difficulties in establishing true basal states for various sized individuals of both sexes and the several races in the setting of varied seasonal fluctuations tends to cause serious re-evaluation of the so-called "tables of normal values" found in most textbooks and other sources. An understanding of biologic rhythmic patterns as plants and animals adapt themselves to the spatial conditions of their environment will obviously ultimately allow optimum scheduling for surgery, giving of medications, and perhaps most important of all, may open the doors to development of far more sophisticated tests for evaluating physiologic phenomena than any now on the horizon. The study of biologic rhythms is a young interdisciplinary science, leaning heavily on the physical sciences. Many answers await the unprejudiced, inquiring mind of medicine.



# STREPTOCOCCAL PNEUMONIA\*

## RECENT OUTBREAKS IN MILITARY RECRUIT POPULATIONS

*LCDR J. L. Basiliere, MC USN, LCDR H. W. Bistrong, MC USN,<sup>†</sup> and  
CDR W. F. Spence, MC USN,<sup>‡</sup> San Diego, California,  
*Amer J Med* 44(4):580-589, April 1968.*

Epidemic pulmonic disease suggestive of streptococcal pneumonia has been described in military populations since the 16th century. McCallum's investigation of this disease in World War I led him to re-examine necropsy material dating to Civil War epidemics. His classic study confirmed a streptococcal etiology in the earlier war and supplied an accurate description of the pertinent pathology. Generally considered to follow in the wake of influenza, measles or pertussis epidemics, much as a secondary invader, this disease has been uncommon since the advent of penicillin. In early reports mortality figures ranged as high as 54 percent.

A unique opportunity to study the clinical and epidemiological facets of this disease was afforded as a result of outbreaks of streptococcal pneumonia at the two military recruit training facilities in San Diego, California, between July 1, 1964, and February 1, 1966. During this period ninety-five cases were treated at the Naval Hospital, San Diego. The present retrospective study was instrumental in initiating a penicillin prophylaxis program in local recruit training facilities.

### Methods and Materials

From July 1, 1964, to February 1, 1966, ninety-five patients with streptococcal pneumonia were admitted to the Naval Hospital, San Diego. Inclusion of cases in this study was dependent upon the clinical and roentgenographic demonstration of pneumonia in association with a sputum culture of group A, beta-hemolytic streptococcus or an antistreptolysin O titer of 250 Todd units or greater, or both. This was a retrospective study of a patient population largely composed of recruits (97 percent) from the U. S. Naval Training Center (NTC) and the U. S. Marine Corps Recruit Depot (MCRD), San Diego, California. Criteria for discharge of these patients from the hospital were the ability to return to a

full duty status or the necessity for separation from the military service. Accordingly, hospitalization time was lengthy. Upon return to duty, all patients were entirely asymptomatic, with normal respiratory function, normal findings on physical examination and either absent or minimal roentgenographic residue.

### Results

*Clinical.* The racial distribution of the ninety-five patients with streptococcal pneumonia roughly paralleled that inherent in the recruit population, 95 percent Caucasian and 5 percent Negro. They came from widespread areas representing mostly Western states. The difference in the number of cases coming from the Naval Training Center and the Marine Corps Recruit Depot reflected relative recruit populations at these two bases. Only 3 percent of the patients were not recruits. The age span was from seventeen to twenty-five years, with an average of 18.9 years.

Ninety percent of the subjects complained of fever. Chest pain was a complaint in 78 percent; in two-thirds of this group empyema subsequently developed. Seventy patients (74 percent) had a cough, fifty of them with purulent sputum. Other commonly occurring symptoms included chills (71 percent), dyspnea (48 percent), hemoptysis (19 percent) and myalgia (13 percent). Sore throat was present in one-third of the patients. Group A beta hemolytic streptococcus was recovered from 19 percent of these (Table 1).

Factors unrelated to the development or course of streptococcal pneumonia included cigarette smoking and antecedent infection of the respiratory tract. Only 21 percent gave a history of prior pneumonia.

Antibiotic therapy prior to admission to the Naval Hospital had been initiated in 30 percent of the cases. Of these 13 percent received penicillin; one was given penicillin and streptomycin, and one received chloramphenicol. The drug most frequently used was tetracycline, used in 15 percent of the cases. The incidence of empyema among the group

\* From the Naval Hospital, San Diego, California. The opinions or assertions contained herein are the private ones of the authors and are not to be construed as official or reflecting the views of the Navy Department, or the Naval Service at large. Manuscript received April 12, 1967.

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TABLE 1.—Prevalence of Symptoms

Symptoms	Cases	
	No.	Per-cent
Fever	86	90
Chest pain	74	78
Chest pain and empyema	49 (66)*	
Cough	70	74
Purulent sputum production	50	53
Chills	68	71
Dyspnea	46	48
Sore throat	31	33
Recoveries of group A, beta streptococci	6(19)*	
Hemoptysis	18	19
Myalgia	12	13

\* Figures in parentheses indicate percent.

receiving antibiotics prior to hospital admission did not differ significantly from the group not so treated.

On physical examination, pharyngitis was discovered in fifty-eight patients, although Streptococcus was recovered from only ten. Of the thirty-seven patients without objective pharyngitis, only three had positive throat cultures. Of those without pharyngitis 60 percent had a positive sputum culture for beta Streptococcus. Of the fifty-eight patients with objective pharyngitis, only twenty-one complained of a sore throat. Streptococci were recovered from only five patients with both objective and subjective pharyngitis (Table 2).

Fifty-two percent of the patients were prominently ectomorphic. In 65 percent of these empyema developed. Adenopathy, petechiae, cyanosis and hypotension were relatively rare findings (Table 2).

The degree of leukocytosis on admission correlated directly with the incidence of empyema. Twenty-three patients (24 percent) had a normal white blood count (5,000 to 10,000 cells per cu. mm.), fifty (53 percent) had between 10,000 and

TABLE 2.—Physical Findings

Physical Findings	Cases	
	No.	Per-cent
Pharyngitis	58	61
Positive throat cultures	10 (17)*	
No pharyngitis	37	39
Positive sputum cultures	22 (60)*	
Prominent ectomorphic	49	52
Associated with empyema	32 (65)*	
Cervical adenopathy	8	8
Petechiae	7	7
Cyanosis	5	5
Hypotension	4	4

\* Figures in parentheses indicate percent.

20,000 cells per cu. mm. and nineteen (20 percent) had a cell count greater than 20,000. Empyema developed in 35 percent of those with a normal white blood count on admission, in 58 percent of those with intermediate counts and in 74 percent of those with white cell counts greater than 20,000 per cu. mm. Anemia, defined as a hematocrit of 35 percent or less, was found in thirty-five patients; in 74 percent of these empyema developed (Table 3).

Group A, beta hemolytic streptococci were cultured from the sputum of fifty-six patients; of these forty-five had nonpathogenic throat cultures (Table 3). Blood cultures were obtained from fifty-seven patients, with recovery of the organism from only one. That patient also had a positive culture of empyema fluid.

Significant antistreptolysin O titers were present in 97 percent of the seventy patients in whom this test was performed. In two-thirds of those with an elevated titer empyema developed.

Temperatures to 102°F. were noted in 32 percent of the patients upon admission; the remainder had higher temperatures. Forty-nine patients had a fever which lasted one week or more; in 71 percent of these, empyema developed.

Penicillin was administered to 74 percent of the patients. Cephalothin and erythromycin were used in the treatment of 4 percent and 3 percent of the patients, respectively. These were subjects considered sensitive to penicillin. Three persons re-

TABLE 3.—Laboratory Data

Laboratory Data	Cases	
	No.	Per-cent
White blood cell count normal on admission	23	24
Empyema	8 (35)*	
White blood cell count 10,000–20,000 on admission	50	53
Empyema	29 (58)*	
White blood cell count greater than 20,000 on admission	19	20
Empyema	11 (74)*	
Anemia, hematocrit 35% or less	35	37
Empyema	26 (74)*	
Positive sputum cultures	56	59
Negative throat cultures	45 (81)*	
Positive throat cultures	12	13
Positive blood cultures	1/57†	2
Positive empyema fluid cultures	16/54†	30
Antistreptolysin O titer elevation	68/70†	97

\* Figures in parentheses indicate percent.

† Figures indicate number of cases involved.



ceived chloramphenicol, three received tetracycline, twelve were given a combination of antibiotics either simultaneously or sequentially. Only one patient was treated for less than two weeks, 25 percent of the patients were treated for more than four weeks. There was one case of true supra-infection with *Aerobacter cloacae*.

Empyema was evident in fifty-four patients, mostly in the left hemithorax (59 percent). Three patients had bilateral pleural effusion. The responsible organism was successfully cultured from the empyema fluid in 30 percent of the cases.

Tube thoracotomy was performed in 52 percent of the patients with empyema. There was a correlation between the amount of fluid removed from the chest on initial thoracentesis and subsequent insertion of a chest tube: 14 percent of those from whom 500 ml. was aspirated, 29 percent of those from whom 500 to 1,000 ml. was aspirated and 57 percent of those from whom greater than a liter was aspirated. "Enzymatic debridement" of the thorax was carried out in all but one of the patients with a chest tube. A streptokinase-streptodornase preparation was utilized. Intrapleural penicillin was administered to 17 percent of the patients with empyema via either needle or chest tube (Table 4).

The average hospital stay for the entire series of patients was seventy-four days. Those with empyema averaged eighty-two days; those without empyema, sixty-two days. Of the patients with empyema, those with a chest tube had an average hospital stay of seventy-six days, which was eleven days less than those who were treated with needle aspiration (eighty-seven days). Ninety-two percent returned to full duty status. Three patients were separated from the service, two for psychiatric reasons and one for bronchiectasis believed to be a residual of streptococcal pneumonia. The ultimate disposition of four patients was not determined.

Residual pleural thickening, usually of minimal extent, was evident in 44 percent of the patients. Ventilation studies were normal in patients with this finding who were returned to duty. Decortications, usually early elective procedures, were performed

in five patients, all of whom returned to full duty. Those operated upon were chronologically the earlier cases. Later, patients were less frequently referred for this procedure (Table 5).

Spontaneous pneumothorax occurred in one recuperating recruit and was treated with needle aspiration. Two patients had significant atelectasis; two patients had pneumatoceles one of which was subsequent to a lung abscess; one patient had a bronchopleural fistula; and one had pericarditis and associated empyema. In one recruit in this series acute glomerulonephritis developed. There were no cases of rheumatic fever and no deaths (Table 5).

*Epidemiology.* During the period of this study there were two distinct peaks in the streptococcal rate. Penicillin prophylaxis was initiated at MCRD in February 1966 and at NTC in early March 1966. This was in the form of benzathine penicillin, 1.2 million units, administered intramuscularly at the end of the second week of training to all recruits not known to be allergic to the preparation. The first period of increased recovery rate extended from November 1964 to May 1965. The rate of recovery from *Streptococcus* infections reached a peak of 9 per 1,000 recruits at NTC in April 1965, and of 7.8 per 1,000 recruits in that same month at MCRD. The second high recovery period reached its peak in January 1966, with rates of 9 per 1,000 at MCRD and 15 per 1,000 at NTC. During this latter period the incidence curve for streptococcal pneumonia closely followed the rate curve for streptococcus recovery. A precipitous decline in the streptococcal rate followed initiation of penicillin prophylaxis.

TABLE 4.—Management of Empyema

Management of Empyema	Cases	
	No.	Per-cent
Tube thoracotomy	38	52
Pleural enzymes	26	48
Intrapleural penicillin	10	17

TABLE 5.—Complications

Complications	Cases	
	No.	Per-cent
Acute		
Empyema	54	58
Left	32 (59)*	
Right	19 (35)*	
Bilateral	3 (6)*	
Significant atelectasis	2	2
Pneumatocele	2	2
Spontaneous pneumothorax	1	1
Bronchopleural fistula	1	1
Pericarditis	1	1
Acute glomerulonephritis	1	1
Rheumatic fever	0	0
Chronic		
Residual pleural thickening	42	44
Bronchiectasis	1	1
Mortality	0	

\* Figures in parentheses indicate percent.



The streptococcal rate refers to the number of positive throat cultures per 1,000 recruits per week. The cultures were obtained from recruits reporting to the dispensary with a complaint of sore throat. The number of throats from which cultures were obtained varied from 34 to 1,255 per week. Group A beta hemolytic streptococci were separated by the bacitracin disc technic of Levinson and Frank. The streptococcal pneumonia rate is defined as the number of cases per 10,000 recruits per week.

The nonsuppurative complications of streptococcal infection, acute glomerulonephritis and rheumatic fever, occurred with minimal frequency (Table 6). Comparing the period from July 1, 1964, to July 1, 1965, with the period from July 1, 1965, to July 1, 1966, a fall in both the incidence of rheumatic fever and glomerulonephritis was noted. In Table 6 the incidence of rheumatic fever and acute glomerulonephritis represents admissions to the Naval Hospitals at San Diego and Camp Pendleton, California. The latter facility was utilized because Marine recruits completed their training at Camp Pendleton. Penicillin prophylaxis was not employed until late in the latter period and can be considered to play only a partial role in the decline of the nonsuppurative complications.

During the period of the study (July 1, 1964, to February 1, 1966) 2,432 patients in all were treated at the Naval Hospital, San Diego, California, for pneumonia of all types. During the period between July 1, 1965, and July 1, 1966, 704 recruits were admitted to the Naval Hospital, San Diego, California, with what was presumed to be a viral pneumonia.

## Comments

Although long recognized an important human pathogen, the Streptococcus has been considered to be an uncommon agent in pneumonia, causing less than 5 percent of all cases. The early observation of MacCallum that streptococcal pneumonia was frequently seen following influenza was confirmed by others, and tended to give the impression that pri-

mary infection of the lungs by streptococci is rare. On the other hand, McFarland in 1946 and Welch et al. in 1961 described such primary infection in a large number of patients, meanwhile observing that the infection resembled previous clinical descriptions of the disease when complicating influenza. Only 36 percent of the patients in the present series had a history of recent respiratory tract infection. The occurrence of these preceding illnesses varied from a few days to two weeks prior to the onset of the pneumonia. There was no difference in the clinical course of the pneumonia, whether or not it was preceded by any overt illness. It should be emphasized that preceding subclinical or minimal infection could not be completely excluded. The absence of antecedent epidemic infectious illness was noteworthy.

The hosts, recruits who made up this study, constitute a very healthy population because of age and the rejection by the military service of subjects with chronic disease. Nonetheless, there are numerous factors which predispose this group to streptococcal disease. The most important of these is the exposure to carriers of Streptococcus brought together from all parts of the country. The ubiquity of the Streptococcus is well known, and although the spread of the organism is slow, once acquired by a susceptible person the chance of infection has been estimated to be about 40 percent, and the secondary carrier rate may be as high as 25 percent. It seems that the Streptococcus is unique in that the likelihood of developing an illness following acquisition of this organism is much greater than for other bacteria. Repeated transfer of the Streptococcus among subjects appears to enhance its virulence. Still another factor involved in these infections is the observation made in several surveys that by the end of the second week of training 90 percent of the recruits have a respiratory tract infection. Recruits are also put through vigorous physical and mental stress to which many of them are not accustomed and which may contribute further to their susceptibility.

Because the cultures to determine the streptococcal rate were taken on recruits reporting to the dispensary with a complaint of respiratory illness, they are biased. Organisms which were not typable by our laboratory were the most prevalent, and then in order of frequency were isolated types: 3, 2, 5, 6 and 12. There was a sharp difference in the incidence of nonsuppurative complications, with a much smaller occurrence in the second epidemic despite the higher incidence rate of streptococcal infection. Only three cases of rheumatic fever were

TABLE 6.—Admissions for Nonsuppurative Complications

Installation	Nonsuppurative Complications			
	Rheumatic Fever		Glomerulonephritis	
	1965	1966	1965	1966
NTC	11	1	1	1
MCRD	6	2	8	3

noted, despite the fact that all strains of streptococci are considered to be rheumatogenic. This observation might be explained in several ways. First of all, many of the complications could have occurred after the patient left recruit training, but previous experience has not supported this explanation. The possibility exists that the decreased incidence of these complications, were subclinical seems unlikely. Lastly, absence of complications could have been the result of prompt and vigorous treatment with antibiotics, although the possibility also exists that all strains of streptococci may not be rheumatogenic.

The periods of peak epidemics in this study were associated with periods of increased populations in the recruit training commands. In a review of U. S. Naval Medical Statistics, it was noted that acute respiratory tract disease was more of a problem at NTC than at MCRD. The following factors were thought to be responsible for this difference: Marine recruits were quickly formed into battalions and were kept separated from the other recruits whereas Naval trainees were not so separated, so that there was a continuous flow of susceptible persons into the group. Marines were quartered in metal huts and each man had more room than a sailor living in open barracks. Finally, there was a heavier medical work load at NTC, reporting to the medical facility was somewhat more difficult and the criteria for retention on the "sick list" were more stringent. It also seems apparent that the incidence of streptococcal disease at both bases is related to the difference in handling these persons. The spread of streptococcal disease in this environment appears to be by direct contact or infective droplet. The acquisition rate of the *Streptococcus* is inversely proportional to the distance between the carrier and the susceptible persons. Fomite and dust laden with streptococci do not produce infections.

The infection rate with streptococci at both bases showed two distinct periods of high incidence, with a corresponding increase in the incidence of streptococcal pneumonia. The obvious and dramatic effect that penicillin had on the rate of both pneumonia and total streptococcal infection is apparent.

The ubiquitous nature of the *Streptococcus* has caused some investigators to believe that the organisms can be accepted as the cause of a pneumonia only if isolated from the lung tissue directly or from pleural exudate. The ninety-five patients in this series all had either a sputum culture of *Streptococcus* and/or an antistreptolysin titer greater than 250 Todd units. All the patients showed roentgenographic and clinical evidence of pneumonia. Their

course was so similar to that described by others that the diagnosis seemed the most reasonable one. Our patients were all in the younger age group and there were no deaths. Keefer et al. found that mortality was greater after the age of forty whereas empyema was more frequent in younger subjects.

The racial distribution of the group was quite representative of the recruit population. The one small exception was the absence of any Malayan patients, which seems unusual considering the significant number of Filipino recruits. There is a marked frequency of exanthematous diseases among this latter group; it would seem likely that some cases of streptococcal pneumonia would have been seen, but they were not.

One striking finding was the number of patients of ectomorphic build in the series. In 52 percent of the cases this feature was sufficiently impressive for the examining doctor to make mention of it. To our knowledge, this has not been noted previously. The significance of this finding is not apparent.

A previous history of pneumonia was obtained in 21 percent of the cases. The value of this finding is limited by the fact that the information was not specifically sought at the time of admission to the hospital, but was noted on retrospective review of the cases. Despite this limitation, the number seems quite significant and is similar to the findings of Welch et al. It seems reasonable to speculate that persons with recurring pneumonias have a respiratory system which is more prone to bacterial pneumonia. A suspicion that streptococcal pneumonia would be more prevalent among smokers or that illness occurring in the group would be more prolonged or associated with a greater incidence of complications was not supported. Fifty-six patients were smokers; empyema developed in thirty-one (57 percent) of these. There was thus no evidence to suggest that the infection behaved differently in smokers than in nonsmokers.

The symptoms presented by our patients were chiefly fever, chills, chest pain and cough. The chest pain was usually pleuritic in type and appeared to be not only a characteristic of streptococcal pneumonia but also a premonitory sign of empyema. Of the seventy-four patients who presented with this complaint, empyema developed in two-thirds. Only a third of the patients complained of a sore throat but on physical examination twice that number showed throat inflammation both with and without exudation. Surprising to us also was the finding that beta hemolytic *Streptococcus* was cultured from only 19 percent of those complaining of sore throat.

A temperature between 100° and 102°F. was noted on admission in 32 percent, the rest of the patients having temperatures higher than this. The febrile state persisted for a week or more in 61 percent; in only 4 percent did it last one to two days. This characteristic persistence of fever has been commented upon by others. Besides being a feature of streptococcal pneumonia, it seemed to presage pleural complications, since empyema developed in 71 percent of those with fever lasting for more than one week.

The white blood cell counts on admission were less than 10,000 per cu. mm. in 24 percent, and 20 percent had 20,000 or more per cu. mm. Again, it was noted that empyema was more frequent in the patients presenting marked leukocytosis. Thirty-five patients were anemic, and of this group effusions occurred in 74 percent. The antistreptolysin O titer was obtained in 74 percent of the cases and was greater than 250 Todd units in 97 percent of these. This test has frequently been employed in the diagnosis of streptococcal infection. Although certain nonspecific factors can cause a false elevation of the titer, the specific reaction can be identified; a rising or extremely high titer is considered diagnostic of streptococcal infection. The rise in antistreptolysin O titer also seemed to relate to the likelihood of development of empyemas. It has been noted that in persons with a very high antistreptolysin O titer the likelihood of developing rheumatic fever is greater.

Success in culturing beta hemolytic *Streptococcus* was somewhat erratic, as already noted. The existence of sore throat did not always augur a positive throat culture. It was further noted that in 59 percent of the patients the streptococci were found in the culture of the sputum, but of these 81 percent had a negative throat culture. Iverson emphasized that throat cultures were unreliable in streptococcal pneumonia because of the frequency with which the organism is found in normal persons. Admittedly, isolation directly from the lung tissue or from pleural exudate would be desirable, but it is not always practical or even possible. It seems to us that the finding of a predominance of streptococci on sputum culture when the other features of the clinical picture are consistent is enough to establish the diagnosis, especially if an elevated or rising antistreptolysin O titer is also found. It would also appear that a positive sputum culture and a negative throat culture would certainly strengthen such an opinion. Blood cultures, however, are rarely positive in streptococcal pneumonia, and in this experience only one

of fifty-seven blood cultures was positive. This is quite in contrast to the findings in pneumococcal pneumonia in which blood cultures are positive in as many as 50 percent of the cases. Pathologically, streptococci usually produce a broncho-pneumonia characterized by inflammation and consolidation about bronchi and bronchioles, which are thickened, inflamed and frequently covered with an exudative membrane. In contrast, primary pneumococcal pneumonias begin as an acute inflammation in the vascular alveolar tissue. This location may be the reason why bacteremia is frequently found in pneumococcal pneumonias.

Nothing in this study led us to alter our conviction that penicillin is the drug of choice in the treatment of streptococcal pneumonia. Sodium cephalothin and erythromycin were employed in 4 percent and 3 percent of cases, respectively, usually because of the existence of penicillin allergy. These drugs were effective but did not show any superiority to penicillin. Chloramphenicol was used alone in 3 percent, although we doubt that this can be justified; the hematologic complications of this drug are well known, and its use to treat infection known to be uniquely sensitive to penicillin and the other drugs enumerated seems quite indefensible. Worthy of comment are the 13 percent of patients who were treated with a combination of antibiotics. The reasons for this are of interest. One of the most important was failure to appreciate the natural course of streptococcal pneumonia and to attribute a prolonged febrile state or the appearance of an empyema to failure of penicillin therapy or to the development of a "suprainfection." Such a misunderstanding of the clinical course has been commented upon by Overholt. Of the entire series, there was but one case of suprainfection, with *Aerobacter cloacae*. Another occurrence which led to the employment of multiple antibiotics was finding another organism on sputum culture, e.g., *Staphylococcus*, and assuming it was a pathogen. The use of tetracycline in the treatment of streptococcal pneumonia also seems to us unwise. The incidence of resistance to this drug has been estimated to be as high as 20 percent. Even if the streptococci are found to be "sensitive" to tetracycline, the drug appears to be less effective than penicillin.

Antibiotics were given to twenty-eight patients (30 percent) prior to hospitalization, usually when the diagnosis was not clear. Penicillin was given to twelve of these; fourteen received tetracycline and one chloramphenicol. There were no noticeable differences in the course of illness of those receiving



antibiotics early and no difference in the frequency with which empyema developed. It has been our observation that tetracycline is generally employed in cases of respiratory tract infections when it is hoped to "cover" a "broad spectrum" of pathogens. There seems to be little evidence that this practice has merit, but rather it is urged that efforts be made to discover a culpable pathogen and treat it with a specific drug.

Empyema occurred in 57 percent of our cases of streptococcal pneumonia. This has been one of the most interesting features of this illness since the descriptions of MacCallum. His explanation of the mechanism by which this complication occurs was that the organism extended in a retrograde manner by way of occluded lymphatics to the pleural surface, and there initiated an inflammatory and exudative response by the pleura. He noted that the thickened pleura was covered with streptococci. When the pneumonia was acute, peribronchial or lobular lesions were seen in the lung; but the pleura was smooth and glistening. If the lung had been infected ten days or more, the pleura was nearly always thickened and its surface covered by a fibrin layer.

Welch et al. observed a striking predominance of left-sided empyemas. In the present series 59 percent of the empyemas occurred on that side. It appears reasonable to suggest that the higher incidence in the left side can be explained by the poorer bronchial drainage from the lower lobe of the left lung, resulting in a more protracted infection in that area. Bronchial involvement is part of the pathologic picture of this type of pneumonia, and exudation into the bronchial lumen is a usual finding. Drainage of involved bronchi seems to be an essential requirement for proper resolution of these pneumonias. Bronchiectasis has been known to favor this site, possibly for the same reasons. It has been noted that streptococcal pneumonia frequently follows a viral infection of the respiratory tract. Such an episode may serve to alter these already narrow air passages and thus encourage localization of the infection to the lower lobe of the left lung.

Of the patients having empyema, twenty-eight were treated with a closed thoracotomy with drainage. All fluid aspirated was noted to have a specific gravity over 1.020 and a protein level greater than 4 gm. percent. In every case the fluid contained large numbers of leukocytes and was a thick green material which was remarkably similar in nearly every case. The average length of hospitalization for these patients was 76.2 days, somewhat below the average for all patients with empyema, which

was 82.1 days. The decision as to which patients were to have a tube inserted was made by the thoracic surgeons and was generally performed in those who were more seriously ill; the others were treated by repeated thoracenteses. Closed thoracotomy with tube drainage is a relatively safe procedure which can be carried out with minimal discomfort to the patient. In addition it usually effects rapid and complete emptying of the pleural space with more rapid recovery and avoidance of the discomfort of repeated thoracentesis, which frequently results in incomplete pleural space evacuation. Maintenance of an inflated lung by removing any fluid present probably prevents formation of thickened pleura and development of lung trapping with the resultant need for surgical decortication.

Intrapleural enzymes were instilled through the thoracotomy tube in the majority of patients in whom a closed thoracotomy was performed. Streptokinase and streptodornase were the enzymes used. There were no obvious complications to this therapy but the benefits obtained were far from impressive. Such therapy is not without risk, and may be complicated by opening of a bronchopleural fistula, hemorrhage and sensitization to the drug, to mention but a few. If enzymes are to be used, it is certainly safer to administer them through a tube rather than by repeated thoracenteses. Our results do not warrant a recommendation for the use of enzymes in empyemas caused by streptococci. The benefits of closed thoracotomy and drainage do not appear to be augmented by their use.

Some residual pleural scarring was seen on roentgenograms in 44 percent of all the cases at the completion of therapy. These patients were all asymptomatic, and their pulmonary ventilation was normal. In several instances patients with extensive pleural involvement, with thickening on roentgenograms, were noted to undergo a striking degree of clearing while under treatment. This emphasized the inability to predict, early in the course of the illness, the patients who would require decortication.

An interesting observation in the series was the occurrence of signs of pleural effusion on roentgenograms which could not be confirmed either by thoracentesis or by closed thoracotomy. At the time of thoracotomy, the pleura was noted to be swollen. To our knowledge, this phenomenon of "pleural edema" has not been noted previously.

Among the ninety-five cases there was only one of acute glomerulonephritis, and this occurred during the fourth week of the patient's illness. There were no cases of rheumatic fever. The average hospital

stay for all the patients with streptococcal pneumonia was 73.7 days. It should be explained that this high figure is due to the unique character of a military hospital. Patients must be kept in a hospital until they have completely recovered from their illness and are capable of returning to the full rigors of active military duty. Perforce all convalescence must be completed prior to discharge; such features as complete absence of rales, rhonchi and wheezing—even upon hyperventilation—as well as essentially complete clearing on roentgenograms must have occurred. Of our entire group, 92 percent were returned to full active duty; and only 3 percent had to be separated from the service. Most of those who were separated were so disposed for reasons unrelated to their illness, e.g., neuropsychiatric problem or maladjustments.

Finally, it has been unequivocally shown that

prophylactic penicillin eliminates this disease. The criteria for the initiation of prophylaxis penicillin have been previously set forth by the Armed Forces Epidemiological Boards Committee on Streptococcal Prophylaxis. The occurrence of streptococcal pneumonia has not previously been considered to be a criterion for the initiation of prophylaxis. It is suggested that the occurrence of streptococcal pneumonia be added as one of the criteria for the institution of prophylactic penicillin.

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(The omitted figures and references may be seen in the original article.)

## HYPOGLYCEMIA IN THE ADULT PATIENT

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*Hypoglycemia may be a vexing diagnostic problem both as to recognition and differential diagnosis. Initially it should be determined if the hypoglycemia is reactive or spontaneous. The latter usually implies the presence of a more serious underlying condition.*

Recognition of hypoglycemia is usually not difficult in the comatose patient or in the patient with the classical symptom complex (hunger, diaphoresis, palpitations, confusion, weakness, nervousness and headache), since blood sugars are obtained routinely in these situations. However, persons with milder degrees of hypoglycemia may present with *isolated* symptoms (anxiety, tremors, nervousness, headaches, depression, narcolepsy, angina, nightmares, or behavioral changes). In the latter case, the diagnosis of hypoglycemia too frequently is not considered by the physician.

Table 1 lists the diagnoses to be entertained in the adult with hypoglycemia. This table does not include the numerous types of hypoglycemia seen in infants and young children. The initial consideration should be to determine if the hypoglycemia is reactive or

spontaneous. Reactive hypoglycemia occurs two to four hours after meals whereas spontaneous hypoglycemia occurs in the fasting state. A five-hour glucose tolerance test is useful in documenting the presence of reactive hypoglycemia. In the adult, reactive hypoglycemia is more frequent, particularly in those patients with only mild depression of the blood glucose.

The most common cause of reactive hypoglycemia is the diabetic or prediabetic state. Circulating insulin antagonists (which inhibit the glucose-lowering effect of endogenous insulin) have been demonstrated in the blood of diabetics and prediabetics. Impeded glucose utilization after meals due to the antagonists may result in a continued stimulus for pancreatic insulin secretion. In the early diabetic with reactive hypoglycemia, an "overshoot" in insulin secretion resulting in hypoglycemia three to four hours after a meal is postulated. The mechanism of reactive hypoglycemia in post-gastrectomy patients is probably similar although hypoglycemia usually occurs somewhat sooner after meals. In this situation, the rapid absorption of dietary carbohydrate may lead to hyperinsulinism with reactive hypoglycemia.

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TABLE 1.—*Causes of Hypoglycemia in the Adult*

- 
- I. REACTIVE HYPOGLYCEMIA
    - A. Diabetic or prediabetic state
    - B. Post-gastrectomy state
    - C. Functional ?
  - II. SPONTANEOUS HYPOGLYCEMIA
    - A. Starvation (including diarrhea, renal glycosuria, lactation)
    - B. Severe liver disease
    - C. Hypofunction of endocrine glands
      - 1. Hypopituitarism
      - 2. Hypoadrenalism
      - 3. Hypothyroidism
    - D. Overdose of insulin
    - E. Oral hypoglycemic agents
    - F. Islet cell tumors
    - G. Non-pancreatic tumors (mesodermal, hepatoma, adrenal carcinoma or miscellaneous)
- 

Many patients with reactive hypoglycemia have neither diabetes nor a history of gastric resection. The label "functional hypoglycemia" has been applied to such persons with the suggestion that perhaps an overactive vagus is responsible. The question of vagal control of pancreatic insulin secretion has been debated for many years, but recent work in our laboratory negates its role in insulin homeostasis. It is the author's opinion that the majority of patients with "functional" hypoglycemia are prediabetic and should be carefully observed for the onset of diabetes.

Spontaneous or fasting hypoglycemia usually implies more serious or acute underlying conditions. Anti-diabetic therapy with insulin or oral hypoglycemic agents must be excluded before considering some of the more exotic causes. Even oral agents with a short half-life of five or six hours, such as tolbutamide, may cause hypoglycemia for days following discontinuance of the drug, particularly in elderly people who may not metabolize the drug normally. Because of their increased susceptibility to drug-induced hypoglycemia, it is wisely recommended that the elderly diabetic be treated with the smallest amount of an oral agent which will correct his carbohydrate tolerance. In persons taking oral anti-diabetic therapy who develop hypoglycemia, it is hardly worthwhile to consider other causes unless the hypoglycemia persists 10 days or more following cessation of drug therapy.

One of the most common causes of spontaneous hypoglycemia seen in metropolitan hospitals is alcohol-induced hypoglycemia. The relatively small number of reported cases belies its true prevalence. Decreased gluconeogenesis related to a disturbance

in the ratio of reduced to oxidized diphosphopyridine nucleotides is thought to be responsible for the hypoglycemia. Alcohol-induced hypoglycemia occurs most commonly in persons who ingest alcohol after a prolonged fast. In fact, it has been shown recently that normal persons fasted for 72 hours will develop depressed blood glucose levels after ethanol administration. Hypoglycemia has been reported as a fatal complication of the ingestion of alcoholic beverages.

Starvation is an unusual cause of hypoglycemia in the civilized Western world, but should be considered in malnourished persons. A form of starvation hypoglycemia occurs rarely during lactation and in persons with malabsorption or renal glucosuria.

Liver disease may also cause hypoglycemia, but severe impairment of liver function should be evident before hypoglycemia is attributed to liver damage. In animals, 80 percent of the liver must be removed before hypoglycemia occurs. Only in patients with hepatomas may mild hepatic dysfunction be etiologically related to hypoglycemia. Statistics from the Orient where hepatomas are particularly prevalent reveal that 30 percent of patients with hepatomas have some degree of hypoglycemia.

Endocrine diseases which may cause hypoglycemia such as hypopituitarism, hypoadrenalism and hypothyroidism usually present no diagnostic difficulties because of the associated signs.

Spontaneous hypoglycemia should always suggest the possibility of an insulinoma. In the majority of cases, the diagnosis is not difficult. If hypoglycemia (below 40 mg. %) is documented anytime during a three-day fast and the other causes of spontaneous hypoglycemia listed in Table 1 are eliminated, exploration of the pancreas is indicated. Plasma insulin levels are desirable but not essential. In fact, plasma insulin levels will be elevated in only 50 percent of fasting samples in patients with islet cell tumors. Repeated fasting determinations, especially during hypoglycemic episodes, offer greater opportunity of finding elevated plasma insulin concentrations. If severe hypoglycemia intervenes during a prolonged fast, a tolbutamide test is not only unnecessary, but is also hazardous. However, if the response to fasting is equivocal, a tolbutamide test is indicated. The insulinoma patient exhibits a greater than normal drop in blood glucose 30 minutes after 1 Gm. of sodium tolbutamide intravenously, but greater diagnostic significance is attached to the persistence of hypoglycemia for three hours after tolbutamide administration. Normally the blood glucose returns to control levels within two hours.



False positive tests may occur. The author has seen one case of hypoglycemia in which the blood sugar remained depressed for three hours, but the insulin levels did not rise outside the normal range. The patient did not have an insulinoma.

Spontaneous hypoglycemia associated with non-pancreatic tumors is now recognized more frequently. Most of these tumors are mesodermal in origin (fibrosarcomas, mesotheliomas, rhabdomyosarcomas), but hepatomas and adrenal carcinomas account for approximately 30 percent. Usually the presence of these tumors is obvious because of their huge size, but occasionally small tumors, particularly of the gastrointestinal tract (stomach and cecum), have caused hypoglycemia. The pathogenesis of the hypoglycemia associated with the non-pancreatic neoplasms remains an enigma. Some favor the hypothesis that the tumor elaborates an insulinoid factor or a substance which potentiates insulin action. This hypothesis might explain the frequent finding of elevated insulin-like activity without an increase in chemical insulin (measured by immunoassay) in these tumors. There is one well-documented case of a fibrosarcoma with elevated plasma immunoreactive insulin. As a general rule, however, if plasma immunoreactive insulin is elevated, an islet cell tumor is the source. Tolbutamide and leucine tests are of little value in distinguishing pancreatic from non-pancreatic tumors causing hypoglycemia.

Usually the cause of hypoglycemia is diagnosed with little difficulty on the basis of history, physical examination and a simple battery of tests consisting of a five-hour glucose tolerance test, three-day fast, urinary steroid determinations, and tolbutamide test, but occasionally the diagnosis may be perplexing. An example of one such instance is presented below:

#### Case Report

A Caucasian woman aged 26, admitted comatose, was found to be severely hypoglycemic. Several blood glucose values were below 30 mg. %. Hypoglycemia recurred if she fasted longer than two hours. Three months earlier she had been admitted during her first pregnancy with second trimester bleeding. Examination at that time revealed a cervical mass which was biopsied and diagnosed as carcinoma of the cervix. Hysterotomy with removal of the fetus was performed and followed by irradiation.

Followup examination revealed the cervical mass to be disappearing with radiation therapy. At the time of her admission for hypoglycemia, enlargement of the liver to 4 cm. below the umbilicus was noted. Liver function was not severely impaired so the diagnosis of a non-pancreatic tumor (presumably carcinoma of the cervix) causing hypoglycemia was entertained. A liver biopsy demonstrated an aplastic metastatic tumor similar histologically to the original cervical lesion. Immunoreactive insulin determinations on five separate occasions showed fasting levels of 50 to 80  $\mu$ v/ml. (upper limit of normal is 30  $\mu$ v/ml.). Because of the elevated immunoreactive insulin levels, it was thought that the patient had a metastasizing insulinoma despite non-diagnostic biopsies. Postmortem exam did show an islet cell carcinoma.

#### Treatment

Treatment depends on the cause of hypoglycemia. Patients with reactive hypoglycemia may be treated with frequent low carbohydrate, high protein feedings. In the early diabetic and even in some of the postgastrectomy patients, reactive hypoglycemia may be effectively treated with pancreatrophic agents.

Insulinomas are treated surgically. In approximately 10 percent of cases, the islet cell tumor is malignant and additional medical treatment may be indicated. Alloxan has been used in the past without much success. A newer agent which seems to hold great promise is diazoxide. Diazoxide is a benzothiadiazine originally synthesized as an antihypertensive agent, but it had to be discarded as such because of its diabetogenic properties. Diazoxide increases blood glucose, elevates free fatty acids, and depresses immunoreactive insulin by stimulating either directly or indirectly alpha and beta adrenergic receptors. Most patients with islet cell carcinomas and some with non-pancreatic tumors producing hypoglycemia will respond to this agent. Other forms of treatment used in refractory hypoglycemia due to tumors consist of glucocorticoids and a high protein diet. A high protein diet is advocated because of the stimulatory effect of carbohydrates on insulin secretion. It is now known that amino acids also stimulate insulin secretion but probably not to the same degree as carbohydrates do.

(The references may be seen in the original article.)

# MEDICAL ABSTRACTS

## SURGERY OF THE ADRENAL GLAND

*Richard H. Egdahl, MD PhD, New Eng J Med 278(17):939-949, Apr 25, 1968.*

The purpose of this article is to present an overview of the adrenal gland from the surgeon's standpoint, with an emphasis on diagnosis and treatment. There is no attempt to review completely the literature on each subject discussed, but rather a selective critique of available information is made. Most of the papers discussed have been published during the last few years. Each of the most common conditions in which adrenal surgery is carried out is discussed separately because the surgical approach varies considerably depending upon the type of abnormality present. More space is given to subjects in which there are recent advances in knowledge such as primary aldosteronism and less to those in which adrenal surgery has a more poorly defined role.

## ACANTHOSIS NIGRICANS: A STUDY OF 90 CASES

*Jack Brown, MD, and R. K. Winkelmann, MD, Medicine 47(1):33-51, Jan 1968.*

The clinical features of 90 patients with acanthosis nigricans seen in the period 1935-1966 were reviewed.

Seventeen patients, 10 males and 7 females, had an associated malignancy: 13 patients had adenocarcinoma, 3 patients had lymphoma, and 1 patient had squamous cell carcinoma.

Six patients with benign acanthosis nigricans, including one patient with total lipodystrophy, had family histories of acanthosis nigricans. The pattern of inheritance appeared to be an autosomal dominant trait.

Drugs were implicated as a cause of acanthosis nigricans in two patients who received nicotinic acid and in one patient who received corticosteroids.

In 20 patients, 11 males and 9 females, an associated endocrine disease was demonstrated.

In 43 patients, 24 females and 19 males, a common disease process could not be demonstrated. Congenital abnormalities were present in some patients, and obesity was a common finding.

The clinical features are similar in all forms of acanthosis nigricans and differ only in extent and severity. Acanthosis nigricans, when associated with malignancy, is more common in persons more than

40 years old; its course is more aggressive, follows the course of the underlying malignancy, and is frequently accompanied by pruritus.

A classification of acanthosis nigricans is presented which assumes that acanthosis nigricans is a cutaneous manifestation of a diverse group of disease processes and may arise in association with malignancies, genetic abnormalities, drugs, and endocrine disease.

A histologic study of 35 patients representing all forms of acanthosis nigricans showed typical features of this disease, and no differences were observed in the histologic pattern between the malignant and the benign form.

Enzyme histochemical study was done on the skin lesions from five patients. The oxidative and hydrolytic enzyme capacity of the involved epidermis in patients with acanthosis nigricans appeared to be increased but is similar to the nonspecific changes of epithelial hyperplasia.

The response to local injury was studied in four patients with acanthosis nigricans. Two patients demonstrated an exaggerated hyperkeratotic response to epidermal injury, thus indicating that local factors may have a part in this disease.

## THE FTA-ABS TEST IN LATE SYPHILIS: A SEROLOGICAL STUDY IN 1,985 CASES

*R. E. Harner, MD, J. L. Smith, MD, and C. W. Israel, MD, JAMA 203(8):545-548, Feb 19, 1968.*

Serology tests were made on 1,985 blood specimens drawn between September 1963 and February 1967. Seven hundred and eighteen cases of late syphilis were identified with the fluorescent treponemal antibody absorption (FTA-ABS) test. Only 441 (61%) patients had a reactive venereal disease research laboratory test for syphilis (VDRL). A sizeable percentage of late syphilitic cases (39%) seen in this study may have been overlooked if only a reagin test had been used to exclude or confirm the diagnosis.

## GASTROINTESTINAL BLEEDING

*C. E. Sedgwick, MD, and J. K. Vernon, MD, Surg Clin N Amer 48(3):523-541, June 1968.*

Hemorrhage from the upper or lower gastrointestinal tract continues to present one of the most

challenging problems faced by the clinician. From massive hematemesis, requiring rapid and decisive action, to intermittent melena, requiring the most careful application of sophisticated diagnostic tools, this event may call upon the surgeon to exercise all the skill at his command. The authors' experience with the problem and the newer diagnostic and therapeutic tools now available are reviewed in this paper.

#### NORTH AMERICAN BLASTOMYCOSIS: A STUDY OF 40 PATIENTS

*P. Witorsch, MD, and J. P. Utz, MD,  
Medicine 47(3):169-200, May 1968.*

During the ten-year period of from 1956 to 1965, 40 patients with North American blastomycosis were studied at the Clinical Center of the National Institutes of Health.

In two-thirds of these patients there was evidence of multiple organ involvement. The lung was affected only slightly less frequently than the skin. Other common sites in order of decreasing frequency were subcutaneous tissue, genitourinary tract, bone, and mucous membrane.

Skin lesions, constitutional symptoms, and respiratory symptoms were the most common complaints. Skin, subcutaneous, genitourinary, and mucosal lesions were the most frequent physical findings.

*B. dermatitidis* was cultured from sputum or from skin lesions in equivalent numbers of 21 patients. Nine other types of specimens also yielded the organism, however. On microscopic examination of stained tissue, organisms resembling *B. dermatitidis* were most frequently seen in skin, lung, and epididymis.

Of the 25 patients who had a blastomycin skin test, none had a positive reaction. Of the 34 patients who had a blastomycin serologic test, only eight had positive results.

The therapeutic agent most frequently employed was amphotericin B. With this drug there was clinical

improvement and failure to culture *B. dermatitidis* from previously positive specimens in 75 percent of 21 courses of treatment. Subsequent relapse occurred in fewer than 20 percent of those who responded. An equal frequency of response but a much higher frequency of relapse occurred in 16 courses of therapy with the polypeptide antifungal agent, X-5079C. There was less improvement after the use of 2-hydroxystilbamidine and the newer agent, hamycin, although experience with these drugs was more limited.

#### ✓ THE ASSESSMENT OF BLOOD LOSS FOLLOWING INJURY

*J. W. L. Davies, PhD, Clin Med 75(5):41, 44,  
45, 48, 49, 53, May 1968.*

Serial red cell volume estimations in a large series of patients with civilian injuries or burns have shown that most injured patients lost clinically significant quantities of blood (i.e., more than two pints) in the absence of blood transfusion within the first two to five hours after injury has occurred.

During the first 24 to 48 hours after injury the total quantity of blood lost was more than three pints in most of the patients and more than 7.5 pints in one quarter of the patients. On average, 50% of the total blood loss occurred during the first three hours after injury and between 80 and 90% of the total blood loss by two days after injury. There was also a significant fall in red cell volume during the first seven to 10 days after injury in many patients.

In patients with burns, the red cell loss increased as the burn size and the time after burning increased. Most patients with burns of less than 40% of the body surface lost between one quarter and one half of their red cell volume during the first three weeks after burning. The patients with very large burns lost between one half and three fourths of their red cell volume during this time.



# DENTAL SECTION

## ANNIVERSARY GREETINGS TO THE DENTAL CORPS

It is gratifying to extend a cordial greeting to members of the Naval Dental Corps as you celebrate your Corps' 56th Anniversary on August 22. As a component of the Medical Department, your combined efforts have been a vital factor in maintaining the overall health of Navy and Marine Corps personnel. During this past year, your accomplishments in the combat theater of Southeast Asia have been outstanding. Enduring many personal hardships, members of your Corps have provided definitive treatment at the front lines and rendered assistance to the Medical Corps as conditions demanded.

Notable during the past year has been the recognition afforded the Dental Corps by the implementation by the Department of Defense of the Navy's Preventive Dentistry Program for Dependent Children throughout the military services. This major achievement signals a landmark in the effort to control dental disease.

Congratulations on this fine year's accomplishments and best wishes for a still brighter future.



R. B. BROWN  
Vice Admiral, MC, USN  
Surgeon General

## FIFTY-SIXTH ANNIVERSARY OF THE U.S. NAVAL DENTAL CORPS

On this 56th anniversary of the establishment of the Naval Dental Corps, I wish to extend my personal greetings and to express my sincere congratulations to all officers of our Corps and to those who have worked with us, both military and civilian. It is through your dedicated and devoted efforts that the mission of the Dental Corps has been carried forth at such a high level of professional excellence. To each and every one of you, I send my cordial regards and wish you a HAPPY BIRTHDAY.



E.C. RAFFETTO  
Rear Admiral, DC, USN  
Assistant Chief of the Bureau of  
Medicine and Surgery (Dentistry)  
and Chief, Dental Division

## RADM RAFFETTO NEW DENTAL CORPS CHIEF

Rear Admiral Edward C. Raffetto, DC USN, was appointed by the Surgeon General, Vice Admiral Robert B. Brown, MC USN, to the office of Assistant Chief of the Bureau of Medicine and Surgery (Dentistry), and Chief, Dental Division, effective 18 July 1968. Rear Admiral Raffetto relieved Rear Admiral Frank M. Kyes, DC USN, who has assumed duties as Director of Dental Activities, Eleventh Naval District, and as Commanding Officer, Naval Dental Center, San Diego, California.

Rear Admiral Raffetto received his DDS degree from the University of Pennsylvania in 1935 and served as an intern at USPHS Marine Hospital, Chelsea, Massachusetts. Upon entering the Naval Dental Corps in 1936, his first assignment was at Naval Hospital, Chelsea, Massachusetts. Prior to World War II he was assigned in Asiatic Station at Cavite, Phillippine Islands, from January 1938 to February 1939 followed by assignment in USS BLACKHAWK from February 1939 to January 1940. During World War II, he saw action in the Gilbert and Marshall Islands campaigns, while serving in USS RELIEF from September 1942 to June 1944. During the Korean conflict he served in USS REPOSE from September 1952 to July 1953.

Since Rear Admiral Raffetto's promotion to Flag Rank on 1 August 1963, he has served as Inspector General, Dental.

## RADM POLLARD RETIRES

Rear Admiral E. G. F. Pollard, DC USN, was placed on the retired list of the Navy on 1 August 1968, after more than 32 years continuous service. His last assignment was Director of Dental Activities, Eleventh Naval District and Commanding Officer, Naval Dental Center, San Diego, California.

Commissioned with a date of rank of 3 March 1936, he has served in numerous assignments. In January 1941, he reported for duty as Dental Officer with the U.S. Embassy Guard, North China Marines, Peking, China. This duty was terminated by the outbreak of World War II and the detention of the Embassy Guard by the Imperial Japanese Army.

As a prisoner of war for 46 months, he was able to render dental treatment to his fellow prisoners. For his efforts in this regard, he was awarded the Legion of Merit.

On 20 January 1961, Rear Admiral Pollard broke his flag at the Naval Dental Clinic, Norfolk, Virginia. The occasion marked the first time such an event

had taken place with an officer of the Dental Corps permanently ordered to a Dental Command. He served in that assignment until he was transferred to San Diego on 1 August 1967.

## CAPT TURNER PROMOTED TO RADM

Captain Myron G. Turner, DC USN, has been designated as Inspector General, Dental, and was recently selected to the rank of Rear Admiral.

He received his DDS degree from Ohio State University in 1936 and interned for one year at Eastman Dental Clinic, Rochester, New York. Upon being commissioned in the Naval Dental Corps in August 1938, he reported to the Naval Dental School, Washington, D.C., for postgraduate instruction and indoctrination. This was followed by assignment to Naval Air Station, Pensacola, Florida, in January 1939. A variety of other duties ensued.

He served as Dental Officer, Marine Corps Recruit Depot, San Diego, California, since July 1966 prior to his current assignment.

## NAVAL DENTAL CORPS CONTINUING EDUCATION PROGRAM

The Continuing Education Courses presented at the Naval Dental School, National Naval Medical Center, Bethesda, Maryland, and those sponsored by Commandant, Eleventh Naval District, Naval Dental Center, San Diego, California, are scheduled as follows during Fiscal Year 1969:

### Naval Dental School, Bethesda, Maryland

<i>Title</i>	<i>Dates</i>
Fixed Partial Dentures	Sept 23-27 1968
Complete Dentures	Sept 30-Oct 4 1968
Removable Partial Dentures	Oct 28-Nov 1 1968
Preventive Dentistry	Nov 4-8 1968
Oral Surgery	Jan 6-10 1969
Oral Pathology	Jan 13-17 1969
Oral Roentgenology	Jan 20-24 1969
Endodontics	Apr 7-11 1969
Operative Dentistry	Apr 14-18 1969
Periodontics	Apr 21-25 1969
Occlusion	Apr 28-May 2 1969

### Naval Dental Center, San Diego, California

<i>Title</i>	<i>Dates</i>
Preventive Dentistry	Sept 16-20 1968
Fixed Partial Dentures	Oct 14-18 1968
Operative Dentistry	Nov 4-8 1968

*Laboratory Procedures for Complete Dentures	Nov 12-14 1968
Endodontics	Jan 6-10 1969
Complete Dentures	Feb 10-14 1969
Oral Surgery	Mar 10-14 1969
Removable Partial Dentures	Apr 7-11 1969
*Command Leadership	Apr 28-30 1969
Periodontics	May 5-9 1969
Oral Diagnosis and Oral Roentgenology	June 2-6 1969

\*Registration limited

Quotas have been assigned to District and Staff Dental Officers for career dental officers. District Commandants have likewise been assigned quotas

for inactive Naval Reserve Dental Officers (Ready Reserve).

For courses at the Naval Dental School, applications from career officers are to be submitted in accordance with current directives and in the format shown in MANMED article 6-130. The Professional Advisory Board will make recommendations on requests, and applicants will be notified regarding final action. Those approved will be nominated for TAD or Authorization Orders as appropriate.

For courses at the Naval Dental Center, San Diego, California, applications should be processed in a similar manner but directed to Commandant, Eleventh Naval District.

Requests from Reserve Dental Officers on active duty will be considered on a space available basis. Such requests will be approved for Authorization Orders only.

## AEROSPACE MEDICINE SECTION

### MASS CASUALTY HANDLING ABOARD CARRIER—PART V

Based on a letter from the Flight Surgeon, Carrier Air Wing—16 aboard USS ORISKANY (CVA-34) October 1966.

Fire and explosion aboard on the morning of the 26th, resulted in a heavy usage of our medical facility. The Senior Medical Officer and the VF-162 squadron Medical Officer lost their lives, and our Medical Service Corps Officer was incapacitated with a possible cervical spine fracture. No corpsmen were injured or lost. The Assistant Medical Officer (Surgeon) had been aboard but six days when the disaster struck. The surviving squadron Medical Officer of VF-163 and CAW-16 staff, set up an advance aid station on the flight deck while the Assistant Medical Officer carried on in the sick bay. When it became apparent that an appreciable number of deaths were involved, the Senior Chief Petty Officer was detailed to set up a temporary morgue in the Hospital Corpsmen's quarters just outside of sick bay, thus clearing sick bay passageways for the treatment of injured and the initial processing of all casualties. All of the deceased were obviously so on arrival in sick bay. Resuscitative measures were attempted on all those felt to have a possibility of benefit. This was administered by three teams of corpsmen under the close supervision

of the Assistant Medical Officer, who also proceeded with triage of all incoming patients, and supervision of burn and wound treatment.

The largest group of patients were primarily smoke and fume inhalation problems. These were coughed-out and given oxygen by mask on the ward. Prior patients on the ward were discharged to provide room. So great was the number of inhalation patients that a shortage of oxygen administration equipment developed; this was adequately handled in sick bay by rotating turns among those less seriously afflicted. On the flight deck, the problem was alleviated by abundant use of seat pan bailout oxygen bottles, administered with standard aviation oxygen mask. Steroid and antibiotic prophylactic therapy was instituted in the more seriously afflicted inhalation patients. Many of those less seriously afflicted patients, after three to four hours rest, requested and were allowed discharge to outpatient status, thereby allowing better care for incoming and remaining patients. The volume of these, with the other activity in the Department at the time, was such that accurate record was not kept on these temporary patients. Fortunately, a smaller number of patients made up the burn and other-wounds group.



All burns were treated closed; lacerations were debrided and sutured. Five significant burn problems were admitted, two of which were sent by air to Da Nang several hours later in the day. The most seriously burned patient, estimated as 35%, also suffered a large scalp laceration and smoke inhalation. Tracheotomy and laceration repair were performed, and blood transfusion was commenced prior to air evacuation. Five days later this patient died of cardiac arrest with renal failure and pulmonary edema at Clark Air Force Base in the Philippines where he had been flown from Vietnam. The other evacuated burn, estimated as 25%, was reported as doing very well at the time. Two third degree burns of lower extremities were transferred to the U.S. Naval Hospital, Subic Bay, after two days of steaming toward port, as was our Medical Service Corps Officer. Injury to the latter was determined to be cervical sprain, and he was allowed to return to light duty before the ship departed Subic Bay.

By the evening of 26 October, fifteen patients were in bed in the sick bay, the rest of the beds being filled with persons having no living accommodations elsewhere. The last of these non-patients left sick bay by the fifth day. The last victim of the fire to be discharged went to outpatient status on the eighth hospital day; he had suffered 5% second degree burns which were healing nicely by this time. Also discharged at this time, to fly home with their part of the air group, were two aviators who had suffered severe smoke inhalation. Hypoxia had almost taken these men, for slight brain damage was evident by visual impairment in one, and slight mental confusion in the other.

The remains of the 43 deceased were rapidly processed and removed to a cold storage area which was made ready by the Supply Department. Clothes and personal belongings of the remains were secured in pillow case bags in sick bay until inventory officers claimed them. In the cold space some of the remains had to be shrouded in waterproof, plastic mattress covers. At Subic Bay, sufficient additional standard burial bags were brought aboard to receive the bodies prior to removal from the ship.

Too much cannot be said of the manner in which all Hospital Corpsmen conducted themselves in the joint effort to relieve pain and suffering, to cooperate with all concerned, and to restore some degree of order as rapidly as possible. Within four hours after the fire had been extinguished, the remains of all deceased had been prepared and removed to storage. Triage proved most effective; liaison between the Medical Department and the ship's Casualty Re-

porting Center was excellent and smoothly effected. Records and treatment of all inpatients were thorough and promptly carried out. Form N's (death certificates) were completed by the following morning with complete identification and fingerprints in all cases.

About eight of our Hospital Corpsmen were unable to reach their general quarters station, but all actively participated in casualty sorting and first aid administration from the hanger deck to the advance aid station on the flight deck. One corpsman has been recommended for the Navy and Marine Corps Medal for his heroic actions in saving two officers from a smoke-filled compartment where they were disoriented and unable to get to safety.

### CI-2 SMOKE ABATEMENT ADDITIVE FOR JP TYPE FUEL

In the air, concealment is just as important as on the ground. To increase the combat effectiveness of certain Navy/Marine Corps aircraft, a smoke abatement additive has been developed. This additive, known as CI-2 (combustion improver No. 2), helps reduce aircraft losses since it eliminates telltale exhaust trails (unburned carbon particles) resulting from incomplete combustion.

The CI-2 is a dark orange liquid, slightly thicker than JP fuel, giving off a faint, pleasant odor (herbaceous). It is more dense than JP or water and will not dissolve in water but will completely dissolve in JP or other hydrocarbon solvents. It freezes at +28 degrees Fahrenheit, has a flash point of +230 degrees Fahrenheit and decomposes to form solid particles in the liquid when exposed to light.

The CI-2 additive has contributed much in reducing the combat hazard to our pilots; however, an additional hazard has been added for those who handle JP fuel. CI-2 is an organic compound containing 25 percent manganese, by weight. Its chemical name is methylcyclopentadienyl manganese tricarbonyl. The manganese, when mixed with fuel, aids the burning of the carbon particles formed during combustion in an aircraft turbine engine. CI-2 is toxic in its solid, liquid and vapor states. In the liquid or solid (residue) state it is readily absorbed through the skin and is especially harmful to the eyes. The vapor is particularly hazardous in an unventilated area. Available information indicates that the toxic effects of CI-2 are similar to those of tetraethyl lead. Percutaneous absorption occurs and the primary site of effect is the central nervous system. Symptoms in acute toxication include headaches, tremors and ataxia; a parkinsonian-like syn-

drome develops. In general, treatment is entirely supportive; however, in acute cases calcium disodium versenate (Ca-EDTA) is recommended. Treatment with Ca-EDTA is by the intravenous method. It is ordinarily given as a 3 percent solution in either isotonic saline solution or a 5 percent dextrose solution. The drug comes as a 20 percent solution in a 5 cc vial (equal to 1 gram). The 5 cc is diluted in 250 to 500 cc of the saline or dextrose solution and administered by slow intravenous drip over one hour's time, twice daily. This dosage may be repeated up to five days. If further treatment is indicated, a two-day rest period is required prior to continuing treatment for an additional 5 days. A toxic nephrosis has been observed to occur following administration of Ca-EDTA; therefore, a pretreatment urine examination and daily urine examination to check kidney function is required. Ca-EDTA may be given orally in a dose of 3 to 4 grams daily; however, this method is not recommended as it has not proven to be too effective. The following symptoms have been noted following the use of Ca-EDTA: headache, nausea and vomiting, malaise, excessive thirst, numbness and tingling (hypocalcemic effect), sudden fever, shaking chills, myalgia, frequency and urgency. Sneezing, nasal congestion and lacrimation have also been noted.

One case of poisoning by CI-2 has been reported since initiation of the use of this compound by Navy combat aircraft. In this case, a squadron maintenance officer had a relatively long exposure to the fumes of CI-2 while investigating leakage from the CI-2 dispensing system installed on an aircraft. Symptoms developed while the officer was working about the aircraft and consisted of: (1) metallic taste in the mouth, (2) headache, and (3) nausea. This individual did not report to sick bay until sometime after the onset of symptoms; upon examination no abnormal findings were elicited. The headache persisted but all symptoms disappeared following a normal period of sleep. No treatment was instituted in this case.

It cannot be overemphasized that personnel who operate CI-2 additive handling and dispensing equipment must be familiar with, and conform to, the promulgated safety precautions and handling instructions. These instructions have been published by the Commander, Naval Air Systems Command, (AIR-536) as a handbook entitled "Procedures for Safety-Storage-Handling-Disposal-and Aircraft Servicing of CI-2 Additive and Additive Systems" dated 1 April 1968. Additive servicing personnel and their supervisory personnel should be required to carefully

study this handbook and be required to strictly observe the detailed operating procedure outlined. Such personnel should be instructed in the recognition of the toxic symptoms which may result following contamination with CI-2 and be thoroughly familiar with decontamination procedures. The following is a brief summary of the safety precautions and decontamination procedures that appear in the handbook:

a. *Protective clothing.* Minimum required is a pair of fuel-resistant and impermeable neoprene or plastic gloves, and a face shield. Coveralls, rubber boots and a head covering are highly desirable, as is a rubber apron, if available. An organic vapor respirator should be used when cleaning up spills occurring in confined spaces.

b. *General decontamination instructions.* All spills should be cleaned up immediately so as not to endanger personnel who may be unaware of the hazards of the additive.

c. *Personnel decontamination.* In case of contact with clothing or skin, remove all contaminated clothing (including boots) and wash skin with JP fuel or dry cleaning solvent (Stoddard solution, FedSpec P-D-680, GSA Stock No. 9Q-6850-264-9038, which is a hydrocarbon cleaning solvent commonly referred to as mineral spirits). The skin must then be washed thoroughly with soap and hot water. Contaminated clothing should be transferred to an isolated area for decontamination or disposal.

d. *Decontamination of clothing.* Contaminated clothing, other than leather goods, may be cleaned for reuse by rinsing in stoddard solution or jet fuel (the rinse fluid must be discarded after use), followed by a thorough washing with soap and water. Shoes and other leather goods cannot be cleaned and may be disposed of by burning. Face shields and masks may be decontaminated in the same manner as clothing.

e. *Cleanup of spills.* Be certain the area is adequately ventilated and avoid inhalation of vapors. Use rags or other absorbent materials to wipe up the spills. Rinse the contaminated areas with solvent or jet fuel and then wash with soap and water. Remove all contaminated materials to an isolated area for disposal, bearing in mind the vapor problem. Rags should be disposed of by burning. The procedures stated in the Aircraft Refueling Handbook, NAVWEPS 06-5-502, should be closely adhered to avoid breathing or igniting the fuel vapors.—Aero-Med, BuMed.

## NAVAL AVIATION GETS NEW JUNGLE RESCUE SYSTEM

The Naval Air Systems Command has adopted a new jungle rescue system that will protect a downed aviator from injury while being hoisted aboard a hovering helicopter.

The new jungle penetrator is a compact bullet-shaped device which has a "pop-out" umbrella and two seats for dual rescue. The umbrella acts as a shield to ward off heavy jungle foliage on the way up to the rescue helicopter. The two seats will enable a helicopter crewman to descend and pick up an immobilized airman.

A study of rescue operations in Southeast Asia combat zones clearly established the need of a device with a protective canopy. Downed airmen faced the hazard of collision or entanglement with branches and vines of the jungle canopy during liftoff operations. Reports of personnel fatality attributable in part to the lack of a protective shield prompted the Naval Air Systems Command to establish the requirement for a protective device as a component of any jungle penetrator developed for search and rescue operations. Further requirements called for a positive jungle penetration capability, easy handling and operation by the survivor, compactness for ease of stowage in the rescue helicopter, and a capability for a dual pickup in the case of an injured airman.

Responding to these requirements, the Billy Pugh Company of Corpus Christi, Texas developed and demonstrated a jungle penetrator/pickup device. The Navy conducted evaluations of this unit in simulated jungle environments at Lakehurst, New Jersey and Warner Springs, California. Following stateside tests, combat experienced helicopter crews conducted tests at the Naval Air Station, Cubi Point, Philippines. This site was selected because of its similarity to the jungle environment of Southeast Asia.

When the jungle penetrator is lowered to a downed airman the compact capsule measures over two and one-half feet in length and eight and one-half inches in diameter. After actuating the "pop-out" mechanism, the dual seated capsule expands to a length of about five feet with the protective canopy extending to three feet in diameter. The capsule weighs forty-eight pounds.

The Naval Air Systems Command is procuring one hundred new penetrators, and Fleet delivery commenced in June 1968.—AeroMed, BuMed.

## EVALUATION OF WATER COOLING SYSTEMS

The Thermal Physiology Team of Aircrew Equipment Department (ACED), Philadelphia, is evaluating the conductive cooling capacity of water circulating in a suitable undergarment. This system has been shown to be effective in reducing the physiological effects of thermal stress in subjects wearing aircrew protective clothing under different environmental conditions. Subjects equipped with a full-pressure suit and exercising on a treadmill to metabolic levels of 800–900 KCal/hour were maintained in a thermally comfortable state with mean weighted skin temperatures of 34.0°C. for periods of one hour. Heart rate increased to levels approaching 150 beats/minute; sweat production was restricted to unconditioned areas of the body such as the head, hands, and feet.

An automatic temperature control system making use of fluid controllers, in order to modulate cooling rates is undergoing refinements in design at the Honeywell, Inc., Systems and Research Center, under the sponsorship of ACED. It is anticipated that the fluid control system will ultimately provide a thermally comfortable suit environment for subjects exposed to stressful environmental conditions.—AeroMed, BuMed.

## NEWS OF AEROSPACE MEDICAL PERSONNEL

Captain Walter L. Goldenrath, MSC USN, Aerospace Physiologist, was guest speaker at the officer initiation banquet of the Survival and Flight Equipment Association (SAFE) held in November in Los Angeles, California. The title of his speech was "Aviator's Personal and Survival Equipment in Southeast Asia". Captain Goldenrath also was guest speaker at the National Meeting of Anesthesiologists held in Los Angeles in November. The title of his speech on this occasion was "Respiratory Problems Resulting from Decreased Barometric Pressure".

A "Symposium on the Application of Human Factors for Systems Effectiveness", sponsored by the Naval Material Command, was held in Washington, D.C. on 16–17 January 1968. Attendees, in addition to those from the sponsoring activity, included representatives from Navy research activities, bureaus and offices, and private industry.

The agenda for this Symposium included sessions on "Personnel Costs and Effectiveness in Systems Development"; "Implementing Research Findings";



"Human Factors Applications in Ship Systems". The session, "Human Factors Applications in Air Systems", was chaired by Lieutenant Commander Thomas J. Gallagher, MSC USN, Bureau of Medicine and Surgery.

On 13 June 1968, 45 new members joined the ranks of Naval Flight Surgeons when Class 118 graduated from the Naval Aerospace Medical Institute, Pensacola, Florida. Included in the class were three foreign medical officers representing France, Germany and the Netherlands. Lieutenant Lawrence D. Rink, MC USNR, received the Surgeon General's Award as the outstanding member of the class. Lieutenant Rink has received orders to Naval Hospital, Rota, Spain, with additional duty as Flight Surgeon with VQ-2 based at Rota.

Presenting scientific papers at the Fourth Joint Army-Navy Conference for Flight Medical Research, hosted by the Naval Aerospace Medical Institute, Pensacola, Florida, 13-14 June 1968, were Commander Channing L. Ewing, MC USN, Head of Bioengineering Sciences at NAVAEROSPMED-INST, and Lieutenant Lewis E. Waldeisen, MSC USN, Psychologist on NAVAEROSPMEDINST staff. Commander Ewing reported on his work in human dynamic response to impact acceleration and Lieutenant Waldeisen discussed the computer controlled investigation of anticipatory physical threat stress which he is conducting.—AeroMed, BuMed.

#### NAVAL SAFETY CENTER IS ESTABLISHED

The Dubois Report, "Review of the Department of the Navy Safety Program" (4 Oct 1967), made recommendations, among others, aimed at consolidation and improvement of many diverse on-going programs. To implement this recommendation the Chief of Naval Operations has directed that the Naval Aviation Safety Center serve as the nucleus for an expanded and consolidated Navy Operations Safety Center.

The Naval Aviation Safety Center is a tenant at the Naval Air Station, Norfolk, Virginia. Plans are under way to expand the facilities at that site and to increase numbers of assigned civilian and military personnel to the extent dictated by the safety programs to be undertaken. The assets of the Submarine Safety Center have been transferred to Norfolk.

Besides aviation, some of the safety areas which will be studied by the new center are: ship, sub-

marine, diving, explosives, industrial, recreation and motor vehicle.

Naval Aviation Safety has developed extremely effective methodology for investigating and reporting accidents, for identifying high incidence and high risk areas and for educating personnel at all levels in safety consciousness. Many aviation safety techniques have been applied to other fields and it is anticipated that the consolidated center will facilitate such interchanges. Techniques for safety systems analysis and safety programs have many common elements, and particularly they have the common goals of reducing injuries, loss of life and equipment, and costs associated with accidents. This should never be at the expense of effective operations, and in fact it has been demonstrated that improved operational readiness is invariably realized when energetic and properly oriented safety programs are pursued.—AeroMed, BuMed.

#### VISUAL STANDARDS FOR STUDENT NAVAL AVIATORS

Flight Surgeons are frequently asked why the visual requirements for acceptance into flight training are so stringent, particularly since the easing of Service Group I standards. The following information, prepared by the Bureau of Medicine and Surgery for the Bureau of Naval Personnel, may be helpful in answering such questions.

1. Flying is a VISUAL TASK regardless of the weather (VFR or IFR) or the area (land or carrier) in which the flight takes place.
2. Visual acuity is basically a product of physiological optics.
3. Experience has taught us that a person in his youth who falls within the extremes of  $-.25D.$  and  $+2.50D.$  and has 20/20 vision can be expected to serve at least ten years in an unrestricted status as an aviator.
4. The visual requirements for Naval Aviation are necessarily stringent due to the environmental factors to which a Service Group I Naval Aviator is exposed, particularly the night carrier approach and landing. The visual landing aids utilized, such as the Fresnel lens system which enables the pilot to determine glide slope, is predicated upon normal visual acuity of 20/20. Aviation medicine experience has shown that *trained* aviators can operate satisfactorily when visual acuity drops to 20/30 uncorrected, but that losses of greater magnitude become intolerable for safety and efficient landing performance. *Trained aviators* whose vision falls to no lower than 20/50 can usually tolerate utiliza-

tion of corrective aviation lenses and maintain proficiency in carrier landing operation, but defects of greater magnitude, even "corrected", are not tolerated. Corrective lens introduce complications such as fogging, interference with oxygen mask, shifting during acceleration (catapult) and deceleration (arrested landing), and in higher corrections restriction of lateral vision and distortion.

5. A random sample of 66 lieutenant commanders and lieutenants in the NFO (1320) program was taken for the years 1953 to 1963. Of the 48 officers with admission vision of 20/20, 45 showed no change in visual acuity. Three showed deterioration to 20/30—a 7% deterioration rate. Of the 18 officers admitted with less than 20/20 vision, there was unacceptable deterioration in 14, a rate of 78%. Losses similar to these in the unrestricted Naval Aviation Program (1310) would be unacceptable and fantastically costly and wasteful.

6. Due to the high visual standards required in Student Naval Aviators, in Fiscal Year 1967 there were only 123 officers in an inappropriate service group because of visual acuity loss. This is in a population of over 14,000 pilots. Seventy-six of these officers have been placed in the next higher service group by virtue of a more liberal use of glasses (only in cases where refractive error is less than -1.25D. with no loss in depth perception or loss in accommodation).—AeroMed, BuMed.

#### NASA LIAISON

*NASA Briefing for Senior Naval Officers.* BU-MED was represented by Captain M. D. Courtney, MC USN, the Navy Surgeon General's representative to NASA for DOD Medical Support of Manned Space Flight, at this briefing given by the Honorable James E. Webb, Administrator of the National Aero-

nautics and Space Administration, and others from that agency. The briefing included discussion of NASA's budget for the next two to three years, a survey of the programs being carried on by NASA and its civilian contractors, and discussion of future plans. Programs of Navy Medical Department interest included the bio-data recording study conducted on naval combat pilots in Southeast Asia; the orientation and vestibular studies being carried on at the Naval Aerospace Medical Institute, Pensacola; and the development of a closed system oxygen system in which the electrolysis of water is used as an oxygen source (one pint of water supplying oxygen to one man for 10 hours), at the Aerospace Crew Equipment Department, Naval Air Development Center, Johnsville. Other examples of Navy support of the Apollo and Apollo Applications program included development and testing of parachutes and related equipment at the Naval Aerospace Recovery Facility, El Centro, California; the training of astronauts, conducted at Johnsville and Pensacola; and survival training given at several Navy survival training schools. Recovery support given past manned space flights was also mentioned. The manned Apollo flights for 1968 were discussed, along with the Saturn I orbiting workshop for 1970 and the larger orbiting workshops for 1972-1973.

*NASA AeroMedical Monitors.* Word has been received from NASA that there is no anticipated further requirement for Navy furnished medical monitors for the Apollo program. Flight Surgeons previously designated as Aeromedical Flight Controllers will be released from such commitment. Automated medical monitoring at the various tracking stations along the flight path will be made with the real time information being relayed directly to the Manned Space Center, Houston.—AeroMed, BuMed.

## EDITOR'S SECTION

### EGGS CONTRIBUTE TO BALANCED DIET

The two-eggs-a-day routine generally observed by Americans may be the correct diet after all, suggests Dr. F. A. Kummerow, in a recent issue of *The Merck Agricultural Memo*, distributed as a service by Merck Chemical Division, Rahway, New Jersey.

In his article, "The Role of Egg Cholesterol in Atherosclerosis," Dr. Kummerow said that it is pos-

sible to assure optimum nutrition by building a diet around animal protein sources such as milk, meat and eggs. These foods provide all the nutrients except vitamin A. Add vegetables, fruits, cereals, and bread to the diet for an adequate protein, vitamin and caloric intake, he said. Eggs serve as an important source of protein in the American diet.

Dr. Kummerow, director of the Burnside Research Laboratory at the University of Illinois and profes-

sor of food chemistry, noted that 90% of all cases of strokes and heart disease are due to atherosclerosis, i.e., deposition of lipids in the arteries.

Lipids are cholesterol and other fat-like materials essential to the structure of all cell membranes. They are manufactured in the body from dietary fats, carbohydrates, or proteins in foods. An egg contains about 400 to 500 mg of cholesterol.

It has been argued that cholesterol in eggs becomes a part of and adds to the total cholesterol in the serum of one who eats eggs, Dr. Kummerow said. Whether or not this is harmful depends on at least two factors. Does the cholesterol from eggs overburden the lipid-carrying capacity of the blood? And, is the cholesterol found in an egg compatible with the cholesterol normally present in the blood?

In answer to the first question, Dr. Kummerow said that "if one assumes that all of the cholesterol in the egg is absorbed into the blood, which in a normal human amounts to four to five liters, the serum cholesterol level would increase only 10 mg %. However, not all of the cholesterol is absorbed and most of the cholesterol that is absorbed is converted into cholic acid in the liver and excreted. Furthermore, the serum cholesterol level is known to fluctuate during a 24-hour period by as much as 20 mg %. Therefore, the increase of 20 mg %, which the daily consumption of two eggs would supply, is of no significance to the overall serum cholesterol level."

Addressing himself to the compatibility of the cholesterol, he said: "The cholesterol in an egg yolk is also combined or carried in the egg as lipoprotein. Therefore, it is consumed with the protein and all of the essential 'carrier protein' is available for resynthesis into lipoprotein in the body.

The prevention of cholesterol buildup depends on controlling the mechanism responsible for lipoprotein stabilization in the blood serum. Dietary fat is no more to blame for the gain in weight than an excessive intake of any other dietary component, he reported. It is far more important to exercise regularly and to eat an adequate calorie-balanced diet, Dr. Kummerow concluded.—The Merck Agricultural Memo, Rahway, N.J.

#### FORENSIC DENTISTRY COURSE

The only forensic dentistry course in the United States, and one of the few in the world, will be held 7 through 11 October 1968 at the Armed Forces Institute of Pathology, Washington, D.C.

Captain Bruce H. Smith, MC USN, The Director of the Institute, said the program is presented to

develop a critically-needed nucleus of dentists trained in the principles of identification and dental jurisprudence.

He said the Institute also "is trying to respond to the urgent, collective requirements of the dental, legal and law enforcement professions."

To accomplish this, Captain Smith said, a distinguished faculty representing the three professions and their important subdivisions will be brought together.

The faculty will include Doctor Soren Keiser-Nielsen, professor of forensic odontology, Royal Dental College, Copenhagen, Denmark. This will be the first opportunity for an American audience to hear Dr. Keiser-Nielsen, a world authority in forensic dentistry, who will bring material from wide clinical experience to the course.

The course director, Colonel William G. Sprague, DC USAF, listed these areas of faculty concern:

- Each of the three professions must be kept aware of the developments, requirements and special techniques of the other professions.

- The legal and law enforcement professions must be acquainted with the continually expanding role dentists can play in identification and criminal investigation.

- Means of accelerating the development of forensic dentistry must be investigated if the United States is not to continue lagging behind the other Western nations in this discipline.

Colonel Sprague said the course "is essential in this country as the sole medium for continuing dialogue among the three professions."

In the science of identification, he said, the spiraling rate of air traffic has posed great challenges to officials. Fires following air crashes destroy the bodies leaving teeth and dental restorations as the only identifying structures.

In criminal investigation many police officers are not aware that the dentist trained in forensic odontology is often able to judge age, sex, race, and even occupation from teeth and associated structures and bite marks.

Police have been helped to solve crimes by forensic odontologists who examined food from which bites have been taken and the imprints of teeth on bodies of victims of violent death.

The faculty of the course will include dentists with experience in forensic odontology, general and oral pathologists, law enforcement officials, lawyers, anthropologists and an identification expert.



Among the lecture subjects will be Recent Advances in Identification, Dental Identification in Mass Disasters, The Relationship between Forensic Dentistry and the Federal Bureau of Investigation, Study of Bite Marks, and Professional Liability.

Unique features of the course include a laboratory session on identification of human remains by comparison of dental records and a mock trial depicting the role of the dentist as an expert witness or defendant.

Members of the law enforcement, legal and dental professions are invited to make application by writing The Director, ATTN: MEDEM-PG, Armed Forces Institute of Pathology, Washington, D.C. 20305. Early reservations are advised.

## TWELFTH ANNUAL SEMINAR ON PROPHYLAXIS AGAINST STREPTOCOCCAL INFECTIONS

The Twelfth Annual Seminar on the Prophylaxis Against Streptococcal Infections sponsored by the Armed Forces Epidemiological Board, Committee on Prophylaxis Against Streptococcal Infections, Commission on Streptococcal and Staphylococcal Diseases, will be held at the Naval Medical Research Unit Number FOUR, Great Lakes, Illinois on Monday and Tuesday, 23-24 September 1968.

Activities desiring to send representatives to this Seminar should submit letter request to BUMED, Attention Code 316, in accordance with BUMED Instruction 1520.8A as soon as possible.

## POSTGRADUATE SHORT COURSES FOR MEDICAL DEPARTMENT OFFICERS

*Sponsored by the Department of the Army During Fiscal Year 1969.*

The following postgraduate professional short courses will be conducted by the Army Medical Service during Fiscal Year 1969. Eligible Medical Corps, Dental Corps and Nurse Corps officers, are those who meet the criteria prescribed by BUMED INSTRUCTION 1520.8 Series; Manual of the Medical Department 6-130; and BUMED INSTRUCTION 1520.14 Series, respectively. Eligible Medical Service Corps officers are those who are currently assigned to billets with a direct relationship to the courses listed and should apply in accordance with BUMED INSTRUCTION 1520.12 Series. Officers desiring to attend should submit their requests in ample time to reach the Bureau at least 8 weeks prior to the convening date of the course desired. This lead time is necessary in order to comply with the Army request to return unused quotas 6 weeks in advance of the convening dates of the courses listed.

<i>Courses</i>	<i>Installation</i>	<i>Date</i>
Advanced Electron Microscopy	Armed Forces Institute of Pathology	2-6 Dec 1968 MC
Advanced Pathology of the Oral Regions	Army Institute of Dental Research, Walter Reed Army Medical Center	10-14 Mar 1969 DC
Aerospace Pathology	Armed Forces Institute of Pathology	13-15 Nov 1968 MC
Application of Histochemistry to Pathology	Armed Forces Institute of Pathology	13-17 Jan 1969 MC
Armed Forces Institute of Pathology Course in Oral Pathology (AnI)	Armed Forces Institute of Pathology	3-7 Mar 1969 DC
Armed Forces Institute of Pathology Lectures (AnI)	Armed Forces Institute of Pathology	24-28 Mar 1969 MC
Army Health Nursing	Walter Reed Army Institute of Research	21-25 Oct 1968 NC

<i>Courses</i>	<i>Installation</i>	<i>Date</i>
Comparative Neuropathology	Armed Forces Institute of Pathology	10-14 Mar 1969 MC
Current Concepts of Restorative Dentistry	Army Institute of Dental Research, Walter Reed Army Medical Center	9-13 Sept 1969 DC
Dietetic Administration	Walter Reed Army Institute of Research	5-9 May 1969 MSC
Environmental Hygiene	U.S. Army Environmental Health Agency, Edgewood Arsenal, Md.	19-31 Jan 1969 MSC MC
Forensic Dentistry	Armed Forces Institute of Pathology	7-11 Oct 1968 DC
Forensic Pathology	Armed Forces Institute of Pathology	19-23 May 1969 MC
Geographic Pathology of Infectious Diseases	Armed Forces Institute of Pathology	7-11 Apr 1969 MC
Introduction to Research Methods	Armed Forces Institute of Pathology	18-22 Nov 1968 MC
James C. Kimbrough Urological Seminar	Walter Reed General Hospital, Walter Reed Army Medical Center	28-31 Oct 1968 MC
Neuropathology	Armed Forces Institute of Pathology	24-28 Feb 1969 MC
Ophthalmic Pathology	Armed Forces Institute of Pathology	16-20 Sept 1968 10-14 Feb 1969 MC
Oral Diagnosis and Therapeutics	Army Institute of Dental Research, WRAMC	14-18 Apr 1969 DC
Oral Surgery	Army Institute of Dental Research, WRAMC Letterman General Hospital San Francisco, Calif.	7-11 Apr 1969 DC
Orthopedic Pathology	Armed Forces Institute of Pathology	30 Sept-9 Nov 1968 MC
Otolaryngology Basic Science Course	Armed Forces Institute of Pathology	14 Apr-29 May 1969 MC
Periodontics	Army Institute of Dental Research, WRAMC Letterman General Hospital San Francisco, Calif.	24-28 Feb 1969 DC
Plastic Surgery in the Military Services—Problems, Reviews, New Developments	Walter Reed General Hospital, Walter Reed Army Medical Center	19-21 Mar 1969 MC
Postgraduate Course in Restorative Dentistry	Letterman General Hospital San Francisco, Calif.	2-6 Dec 1968 DC

<i>Courses</i>	<i>Installation</i>	<i>Date</i>
Present Concepts in Internal Medicine	Letterman General Hospital San Francisco, Calif.	19-22 Nov 1968 MC
Preventive Dentistry	Army Institute of Dental Research, WRAMC	14-18 Oct 1968 DC
Prosthodontics	Letterman General Hospital San Francisco, Calif. Army Institute of Dental Research, WRAMC	7-11 Oct 1968 18-22 Nov 1968 DC
Radiologic Pathology	Armed Forces Institute of Pathology	1 Oct-31 Dec 1968 3 Jan-28 Mar 1969 1 Apr-27 Jun 1969 MC
Special Environmental Pathology	Armed Forces Institute of Pathology	28 Apr-2 May 1969 MC
Surgical and Orthopedic Aspects of Trauma	Brooke General Hospital, BAMC, Ft. Sam Houston, Texas	3-6 Mar 1969 MC
Symposium on Pulmonary Diseases (Anl)	Fitzsimons General Hospital Denver, Colorado	16-20 Sept 1968 MC
Tri-Service Pediatric Seminar (The Ogden C. Bruton Pediatric Seminar)	West Point Military Academy	5-7 Mar 1969 MC
Gary P. Wratten Surgical Symposium	Walter Reed General Hospital, Walter Reed Army Medical Center	14-16 Apr 1969 MC

A copy of Army Circular 350, which provides detailed information on the above listed courses, will be forwarded to all Naval Hospitals.—Training Branch, BuMed.

#### AMERICAN BOARD CERTIFICATIONS

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